

US EPA RECORDS CENTER REGION 5



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# QUALITY ASSURANCE PROJECT PLAN

2003

**QUALITY ASSURANCE PROJECT PLAN**  
  
**for**  
  
**SUPERFUND**  
**CERCLA SITE INVESTIGATIONS and BROWNFIELD INVESTIGATIONS**

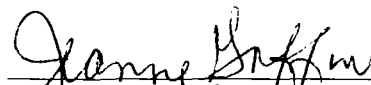
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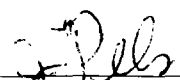
  
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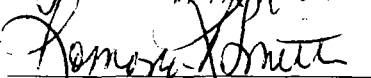
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### List of Acronyms/Abbreviations

ARARs	Applicable or Relevant and Appropriate Requirements
ASTM	American Standards for Testing Materials
BNA	Base-Neutral-Acid Extractables (Semivolatile Organics)
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Chain of Custody
CLP	Contract Laboratory Program
CRDL	Contract Required Detection Limits
CRQL	Contract Required Quantitation Limits
CRL	Central Regional Laboratory
DCF	Document Control Format
DQO	Data Quality Objective
EMSL	Environmental Monitoring and Support Laboratory
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NIST	National Institute of Standard Technology
NPL	National Priorities List
OSC	On-Scene Coordinator
QA/QC	Quality Assurance/Quality Control
QAMP	Quality Assurance Management Plan
QAPP	Quality Assurance Project Plan
RAS	Routine Analytical Services
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
RD/RA	Remedial Design/Remedial Action
RPM	Remedial Project Manager
FSP	Field Sampling Plan
SARA	Superfund Amendments and Reauthorization Act
SAS	Special Analytical Services
SMC	Sample Management Coordinator
SOP	Standard Operating Procedures
SOW	Statement of Work
SW846	Test Methods for Evaluating Solid Waste 1986
TAL	Target Analyze List
TCL	Target Compound List
TIC	Tentatively Identified Compound
USEPA	United States Environmental Protection Agency
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound

## **1.0 PROJECT DESCRIPTION**

### **1.1 INTRODUCTION**

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA or Superfund) was passed on December 11, 1980. Among many things this law authorizes the United States Environmental Protection Agency (EPA) to respond to releases or threats of releases of hazardous substances, or pollutants or contaminants into the environment which may present an imminent or substantial danger to public health, welfare or the environment. There are three primary ways sites can be cleaned up with CERCLA authority: enforcement removal actions, and remedial activities. Each of these ways are discussed in detail below.

This Quality Assurance Project Plan (QAPP) is a compilation of methods and procedures which are followed by the Illinois Environmental Protection Agency (IEPA) Site Assessment Program to ensure quality in site investigations. This QAPP provides guidance to fulfill the requirements of CERCLA in protecting human health and the environment.

#### Data Quality Objectives

The Data Quality Objectives (DQO) Process, a systematic planning tool based on the Scientific Method for establishing criteria for data quality and for developing data collection designs. By using the DQO Process to plan environmental data collection efforts, EPA can improve the effectiveness, efficiency, and defensibility of decisions in a resource-effective manner. The DQO process used by the Site Assessment Program will be based on the process described in "Guidance for the Data Quality Objectives Process", September, 1994. EPA QA/G-4:EPA/600/R-96/055.

DQOs are qualitative and quantitative statements derived from the outputs of the first six steps of the DQO Process that:

- 1) Clarify the study objective;
- 2) Define the most appropriate type of data to collect;
- 3) Determine the most appropriate conditions from which to collect the data; and
- 4) Specify tolerable limits on decision errors which will be used as the basis for establishing the quantity and quality of data needed to support the decision.

The DQOs are then used to develop a scientific and resource-effective data collection design.

The DQO Process is a strategic planning approach based on the Scientific Method that is used to prepare for a data collection activity. It provides a systematic procedure for defining the criteria that a data collection design should satisfy, including when to collect samples, where to collect samples, the tolerable level of decision errors for the study, and how many samples to collect. By using the DQO Process, the Agency will assure that the type, quantity, and quality of

environmental data used in decision making will be appropriate for the intended application. In addition, the Agency will guard against committing resources to data collection efforts that do not support a defensible decision.

The DQO Process consists of seven steps, as shown in below. The output from each step influences the choices that will be made later in the Process. Even though the DQO Process is depicted as a linear sequence of steps, in practice it is iterative; the outputs from one step may lead to reconsideration of prior steps. This iteration should be encouraged since it will ultimately lead to a more efficient data collection design. During the first six steps of the DQO Process, the planning team will develop the decision performance criteria (DQOs) that will be used to develop the data collection design. The final step of the Process involves developing the data collection design based on the DQOs. The first six steps should be completed before the planning team attempts to develop the data collection design because this final step is dependent on a clear understanding of the first six steps taken as a whole. Above all, every step should be completed before data collection begins.

Each of the seven steps is described briefly below.

- Step 1: State the Problem — Concisely describe the problem to be studied. Review prior studies and existing information to gain a sufficient understanding to define the problem.
- Step 2: Identify the Decision — Identify what questions the study will attempt to resolve, and what actions may result.
- Step 3: Identify the Inputs to the Decision — Identify the information that needs to be obtained and the measurements that need to be taken to resolve the decision statement.
- Step 4: Define the Study Boundaries — Specify the time periods and spatial area to which decisions will apply. Determine when and where data should be collected.
- Step 5: Develop a Decision Rule — Define the statistical parameter of interest, specify the action level, and integrate the previous DQO outputs into a single statement that describes the logical basis for choosing among alternative actions.
- Step 6: Specify Tolerable Limits on Decision Errors — Define the decision maker's tolerable decision error rates based on a consideration of the consequences of making an incorrect decision.
- Step 7: Optimize the Design — Evaluate information from the previous steps and generate alternative data collection designs. Choose the most resource-effective design that meets all DQOs.

The site specific Work Plans and Field Sampling Plans for each Site Assessment will contain the details of how the DQO process was applied to each site.

## **1.2 ENFORCEMENT**

CERCLA grants EPA broad authority to take action against responsible parties, including owners, operators and generators, to bring about response action at sites. Responsible parties can be held liable for up to three times the cost of clean up if Superfund monies have to be used to clean up a site.

## **1.3 REMOVAL**

The removal program allows EPA to respond to releases quickly, thereby mitigating immediate threats to human health and the environment. However, recent amendments to the National Contingency Plan (NCP), which is EPA's plan for addressing releases of hazardous materials, expand removal authority to also cover situations not routinely thought of as immediate removals. Therefore, releases or threats of releases at or near the surface, independent of whether they pose an immediate threat, may now be addressed under the removal program. These removal actions are defined as time-critical and non-time critical removal actions depending on the site and the situation.

The primary limitation to removal actions is, that they can cost no more than \$1 million and last no more than 6 months unless continued response (1) is required to prevent, limit or mitigate an emergency, (2) there is an immediate risk, (3) and no one else will provide the assistance.

The two key groups that oversee removal actions are the Coast Guard and EPA. The Coast Guard primarily responds to releases of hazardous materials in coastal areas and will support EPA at inland areas when requested. EPA primarily responds to inland releases through its contract technical assistance team (TAT) and Emergency Response Cleanup Services Contracts (ERCS). The TAT contractor, among other things, has responsibility for conducting preliminary assessments for removal actions and directing removal actions. The ERCS contractor has responsibility for implementing the selected removal actions including contaminant and countermeasures; cleanup, mitigation, and disposal; site restoration; and analytical services.

The removal program is designed to respond to releases more quickly than the remedial program which requires National Priorities List (NPL) listing. However, the Site Assessment program has become more active in removal actions. The Regional Integrated Site Evaluation (RISE) Information form is the primary mechanism by which cooperation and communication between



removal and remedial programs occurs. RISE forms include all pertinent site information including a site description, a summary of previous investigations, potential targets, and a description of the hazardous waste present. RISE forms and recommendations are shared and coordinated between programs as sites are discovered. If State personnel confront immediate removal situations, and the State is unable to take response actions or force responsible parties to take response actions, the site should be promptly referred to the EPA Regional office for action. These sites are referred to EPA by completing this RISE form which in turn initiates the above process.

## **1.4 REMEDIAL**

### **1.4.1 DISCOVERY**

Discovery is the process of identifying previously unknown potential hazardous waste sites. Sources for this information could include, but are not limited to the following:

- informal community site notification hot lines, citizen complaints
- Federal/State site notification programs and referrals
- historical or recent aerial photo imagery
- land use records
- other sources

When a site initially comes to the attention of the Site Assessment or Removal programs, it is not automatically entered into EPA's Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS). Sites now undergo an initial screening by representatives of the remedial and/or removal programs. The site is entered into CERCLIS if further site investigation is deemed necessary by completing a RISE form. It should be noted that CERCLIS is not a comprehensive list of all potential sites in the country--only those that have been reported to EPA.

### **1.4.2 INTEGRATED ASSESSMENT**

(PRELIMINARY ASSESSMENT/SCREENING SITE INSPECTION EQUIVALENT)

The Integrated Assessment (IA) was developed to provide a means to conduct a single evaluation process for site assessment and removal concerns. It consists of a single continuous site

evaluation, which combined the activities of the Preliminary Assessment and the Screening Site Inspection. An IA also includes a removal program analysis component. Generally, an IA examines hazardous waste sites to determine if a site poses a threat to human health and/or the environment, to determine if a removal action is warranted, to better define the extent of the problem, to determine if further action is warranted, and to provide a data base sufficient to apply the EPA Hazard Ranking System (HRS) which is described in Section 1.4.6.

After site discovery and the RISE process is complete and both programs have determined that further investigation in conjunction with a removal action, following a removal action, or in the absence of any removal action is necessary, the site is placed on CERCLIS and an Integrated Assessment begins. The RISE form is forwarded to the Early Action Project Manager in the Emergency Response Branch of the Superfund Division, who in turn will provide the information to the Region 5 Removal Program. If the potential for a removal is present, then the State will contact the Regional Removal representative and every attempt will be made to coordinate the initial site activities, especially the reconnaissance visit.

A variety of information is necessary to complete the IA including site specific data on the hazardous substances present, pollutant dispersal pathways, types of receptors, facility management practices, and readily known potential responsible parties. The scope of an IA can vary depending on the nature of existing information available on the site.

The following types of tasks are appropriate for an IA:

- review of files; reports; well logs; aerial imagery; flood insurance maps; Sanborn Maps; U.S. Geological Survey, Soil Conservation Service information; and other geological, hydrological, and topographical data
- conduct a site reconnaissance visit
- screen site with portable field instruments for air releases and radioactivity
- survey and document the site, structures, topography, lagoons, drainage, drums, bulk tanks, monitoring wells, roads, access points, boundaries, etc.
- document location of potentially affected homes, public buildings, natural areas, other populations, etc.
- identify migration pathways and sources of hazardous waste
- review operator records
- screen samples before collection with the Toxic Vapor Analyzer (TVA) and perhaps

conduct other screening activities with Immunoassays and/or X-ray fluorescence depending on the site

- use the Geoprobe to gather data on site geology and to collect groundwater samples
- collect/analyze on and off-site, sediment surface soil, open drums and waste samples for volatile organic compounds, extractable organic compounds (this includes base/neutral extractables, acid extractables, and pesticides/ polychlorinated biphenyls (PCBs)), and inorganic compounds
- collect/analyze groundwater and surface water, and or lagoons for volatile organic compounds, extractable organic compounds (this includes base/neutral extractables, acid extractables, and pesticides/PCBs), and inorganic compounds
- HRS scoring

An important task of the IA, as mentioned above, is sample collection. When the decision is made to proceed with sampling, the State will notify the Early Action Project Manager with a correspondence including a workplan and a PA-Scoring package. Under the Site Assessment program, an average of 10-20 samples per site is routine. In addition to collecting samples for the HRS score, consideration is given to removal assessment and possible initial remedial investigations needs. States should attempt, where feasible, to limit sample collection to this amount. However, this amount may not be appropriate considering the size, complexity, nature of the pathways and the amount of existing reliable analytical data. If it is impossible to effectively score the site with 20 samples then it is appropriate to collect more.

Completion of the IA will generally include a formal report which addresses the site history, operations, waste characteristics, and a discussion of the migration pathways. The report will also include photographic documentation, site and area maps, presentation of analytical data, and a PreScore scoring package. Also, accompanying the report will be a site recommendation. Based on the information collected, one of the following decisions/recommendations must be made:

- no further remedial action planned (NFRAP)
- further investigation
- proceed with HRS scoring package

During the initial stage of the Integrated Assessment investigation, it may be determined that a site does not pose a threat to human health and/or the environment. In this case a NFRAP Integrated Assessment (Preliminary Assessment Equivalent), which is an abbreviated version of an Integrated Assessment, is the result. This decision usually comes after a review of all pertinent information (including removal action information, if applicable) and a site reconnaissance visit. The information available suggests that this site does not pose a threat and that sampling is not necessary. This investigation should characterize any hazardous substances present, potential

migration pathways, and the potential populations and resources that may be affected.

A NFRAP Integrated Assessment may include the following tasks:

- review of files; reports; well logs; aerial imagery; flood insurance maps; Sanborn Maps; U.S. Geological Survey, Soil Conservation Service information; and other geological, hydrological, and topographical data
- conduct a site reconnaissance visit
- identify potential targets, migration pathways, and sources of hazardous waste
- screen the site with portable field instruments for air releases and radioactivity
- survey and document site, structures, topography, lagoons, drainage, drums, bulk tanks, monitoring wells, roads, access points, boundaries, etc.
- review operator records

A report that is the equivalent of a Preliminary Assessment will be completed and accompanied by a PreScore scoring package.

#### **1.4.3 SITE TEAM EVALUATION PRIORITIZATION (STEP)/ESI EQUIVALENT**

The Site Team Evaluation Prioritization (STEP)/ESI Equivalent was developed to allow for additional investigations beyond the previously completed Preliminary Assessments, Screening Site Inspections, or IAs to provide sufficient documentation to decide on the appropriate future course of action for sites. The purpose of a STEP/ESI Equivalent is to gather additional information to further assess potential site concerns and to assist in determining if a site is eligible for the NPL.

Much of the same information and tasks necessary for the completion of the Integrated Assessment is also necessary for a STEP/ESI Equivalent investigation. However, most of this information has already been gathered in the Preliminary Assessment and the Screening Site Inspection. Therefore, the STEP/ESI Equivalent is utilized to fill in data gaps and make a determination if the site is an NPL candidate. The types of tasks appropriate for a STEP/ESI Equivalent include the following:

- gather updated information regarding site operations, hazardous wastes, and disposal procedures

- collect samples to fill in data gaps and to further identify affected or potentially affected target populations and/or resources
- analyze samples for volatile organic compounds, extractable organic compounds (this includes base/neutral extractables, acid extractables, and pesticides/PCBs), and inorganic compounds
- quantify the threats posed by a site to support HRS scoring
- collect additional samples to attribute hazardous substances to site operations

Again, before sampling activities are conducted, the State will notify the Early Action Project Manager with a correspondence including a workplan and a PA-Scoring or a PreScore package. The number of samples collected during the STEP will range from a few up to the number typically collected during a CERCLA Expanded Site Inspection. The nature and amount of field work will be dictated by the existence of available information on the site. Again, a report accompanied by an updated PreScore scoring package and a site recommendation will be completed. Based on the information collected, one of the following decisions/recommendations must be made:

- no further remedial action planned (NFRAP)
- further investigation
- proceed with HRS scoring package

#### **1.4.4 EXPANDED SITE INSPECTION (ESI)**

Expanded Site Inspections (ESIs) are optional activities. The objective of the Expanded Site Inspection is to collect all data necessary to prepare an HRS scoring package to propose the site to the NPL. In most cases, Expanded Site Inspections are necessary for complex sites where additional data is needed to substantiate or strengthen an HRS score. Expanded Site Inspections may also be needed to further define the extent or potential for contamination, more extensively determine the identity/quantity of waste materials or contaminants disposed on site, better identify/quantify target populations or environments.

The more conventional activities and techniques often provide enough data to score a site for the NPL. However, in some instances additional information and more sophisticated technology may be necessary especially for complex sites. Before additional sampling activities are conducted, the State will notify the Early Action Project Manager with a correspondence including a workplan

and a PreScore package. Appropriate tasks may include:

- conducting interviews with those knowledgeable about the site
- installing wells to obtain better data on the presence of contaminants in groundwater
- collecting samples to attribute hazardous substances to site operations
- collecting samples to further identify targets
- conducting geophysical studies
- conducting complex background sampling studies
- collecting any other missing HRS data for the pathways of concern

After an Expanded Site Inspection is completed sufficient information and documentation exists to proceed with NPL listing.

#### Data Usage and Assessment

In the Site Assessment Program, sampling and the associated analytical work are necessary for Integrated Assessments, Site Team Evaluation Prioritizations, and Expanded Site Inspections. The primary purpose for this analytical work is to complete a site characterization using the HRS. For most sites where unknown contaminants may be present, samples are analyzed for the Target Compound List (Refer to Tables 5-1 through 5-4). This analytical data may also be of secondary use in the Remedial Investigation or in relation to public health concerns. The Remedial Investigation is, however, designed to develop an analytical data base for contamination assessment and public health concerns that is independent from and more intensive than the analytical data of the Site Assessment program (Refer to Section 1.4.7).

Samples are sent to the USEPA Contract Lab Program or to IEPA labs. Soil, sediment, waste, surface water, and groundwater analyses all undergo data assessment by Quality Assurance Coordinators and the laboratory managers for the data produced in their laboratories. The data assessment will be done in terms of instrument conditions, initial calibration, continuous calibration, verification, method blanks, field blanks, matrix spike recovery, duplicate analyses, matrix spike duplicates, surrogate compounds recovery and laboratory control sample analyses. All of the analyses and recoveries must meet established limits (Refer to Appendix E). For samples sent to IEPA labs, the IEPA Quality Assurance Section will manually validate the data package prepared by the laboratory equivalent to Contract Lab Program requirements and results will be reported to the Site Assessment staff of the Division of Land Pollution. For samples analyzed through the Contract Lab Program, data is validated by ESAT manual data validation or reviewed by a Computer-Aided Data Review and Evaluation (CADRE) software. If a CADRE

review is conducted, it should be noted that, if needed, a full manual data review can be requested in the future. However, for ESIs or sites with a known scoring potential a manual review should be requested before samples are analyzed. The analytical results are then sent to US EPA and forwarded to the Site Assessment staff.

The target parameters and associated reporting/detection limits for the Site Assessment Program are contained in Appendix E.

Site Assessment staff then compute the HRS score using this analytical data. The analyses are compared to the background level and/or detection limits. Any parameter with a value that is three times greater than the background concentration or greater than the sample quantitation limit if the parameter is undetected in the background sample represents an observed release to the environment. The absence or the confirmation of an observed release is a significant factor in the computation of the HRS score. This analytical data, staff recommendations and conclusions, and reports are reviewed by the Illinois Site Assessment Program Manager. After needed corrections are made, the report and the HRS score will be transmitted to USEPA, Division of Superfund, Emergency Response Branch, Response Section 3 for review.

#### **1.4.5 SITE ASSESSMENT TEAMS (SAT)**

A Site Assessment Team is formed at the request of the Site Assessment Program manager. The objective of the SAT is to discuss and determine a site strategy. The various topics of discussion will vary from site to site, however, common topics include identifying potentially responsible parties, assessing public health concerns and ecological risks, discussing the need for a removal action, and enforcement issues. A Site Assessment Team consists of State members representing a variety of programs including, but not limited to, the Site Assessment Unit, the National Priorities Unit, Legal Council, and the Community Relations Unit. However, it may be beneficial to have other individuals or program representatives with knowledge of the site on the team.

#### **1.4.6 HRS/NPL**

The Hazard Ranking System (HRS) is a model developed and designed to rate the relative severity of a hazardous waste site against other sites. The score is based on (1) the relative potential of substances to cause hazardous situations, (2) the likelihood and rate at which the substances may affect human and environmental receptors, and (3) the severity and magnitude of potential effects.

Appropriate activities include:

- assemblage of all the information required to develop a hazard ranking score
- preparation of the formal documentation record and supporting information

- development of the scoring package

The National Priorities List (NPL) is compilation of the highest priority sites in the country. Each site included on the NPL was scored using the HRS. Congress mandated that EPA publish and update this list on a regular basis. A site must be listed on the NPL in order to be eligible for remedial action. However, it is important to note that enforcement activity is not specifically relevant to NPL considerations. EPA's policy is to score all sites regardless of their enforcement status. This will ensure fair and equitable treatment of all sites.

Ultimately, it is the responsibility of the EPA to recommend sites for NPL consideration. However, States also have a role in reviewing and commenting on recommended sites. A Regional Decision Team (RDT) may be formed to determine which sites should proceed with placement on the NPL. The RDT consists primarily of members from the EPA, however, at least one member from the state usually is presented or consulted. Often, a SAT will provide relevant information.

The following is an outline of the chronology by which sites are submitted for NPL consideration:

- apply HRS scoring system
- submission of information/NPL package
- Regional quality control
- EPA-Headquarters quality assurance audit
- sites that pass are published in the Federal Register
- sites pass through 60 day public comment period
- sites successfully passing through comment period are published as final in the Federal Register
- litigation

When a site is submitted to EPA Headquarters for NPL consideration, the submittal must contain the following components:

- complete set of HRS worksheets
- documentation record



- bibliography of information sources
- short narrative summary for press release

Once a site has been scored using the HRS and submitted for NPL consideration, the Region performs a quality control review. This QC review involves:

- ensuring that submittal is complete
- ensure correct arithmetic and language
- ensure scores for individual factors are appropriate based on information in the documentation record
- resolve and correct with preparer any errors or discrepancies

EPA-Headquarters QA involves:

- ensure accurate interpretation of technical data and arithmetic assignment of HRS values
- ensure consistent inter region EPA policy application
- ensure equitable treatment for all sites nationally
- ensure technically valid professional judgement exercised

After the entire review process is complete, a letter from the Governor (or an appointee) recommending the site be listed on the NPL is necessary for listing. This process should be initiated as early in the site assessment process as practical, ideally before initiating a HRS package.

#### **1.4.7 REMEDIAL INVESTIGATION (RI)**

After a site is placed on the NPL, a remedial investigation is completed to assist in determining the remedial course of action. A remedial investigation is an investigation intended to gather the data necessary to:

- determine more precisely the nature and extent of problems at the site
- establish cleanup criteria for the site

- identify preliminary alternative remedial action
- support the technical and cost analyses of the alternatives

In order to conduct a remedial investigation and all activities subsequent to a remedial investigation, the site must be listed on the NPL.

#### **1.4.8 FEASIBILITY STUDY (FS)**

A feasibility study is intended to:

- evaluate alternative remedial actions from a technical, environmental, and cost-effectiveness perspective
- recommend the cost-effective remedial action
- prepare a conceptual design, cost estimate for budgetary purposes, and a preliminary construction schedule

#### **1.4.9 REMEDIAL DESIGN (RD)**

In this phase of a remedial action, the selected remedy is clearly defined in a bid package so that the remedy can be implemented. It can take the form of a site cleanup plan, a relocation plan or engineering drawings and specifications.

#### **1.4.10 IMPLEMENTATION/CONSTRUCTION/REMEDIAL ACTION**

The construction phase is the phase at which actual clean up occurs based upon the designs prepared in the design phase. Implementation can range from building containment structures, removal of drums, installation of fences, relocation of residents, provision of alternative water supplies, installation of site monitoring systems, construction of clay caps, etc.

### **1.5 REDEVELOPMENT ASSESSMENTS (RA)**

Changes have occurred in the remedial portion of the Superfund program resulting in another type of site investigation. A portion of the CERCLA site assessment funds have been allocated to

complete assessments at Brownfield sites. The Brownfield Initiative came about from an effort to clean sites up without the traditional CERCLA process. Brownfields are typically abandoned, idled, or under-used industrial and commercial properties where redevelopment is complicated by real or perceived environmental contamination. The purpose of a Redevelopment Assessment is to determine if any environmental or public health concerns exist at a Brownfield site which may impede future redevelopment of the property. The Brownfield Initiative and in turn Redevelopment Assessments are intended to assist states, communities, owners, and other stakeholders in the economic redevelopment of these properties.

Generally, potential sites will be identified through a cooperative effort with communities, municipal officials, and the state. As a result, the state and the community work in cooperation toward the property redevelopment.

RA investigations will gather information about the site including the location of past and present industrial activities at the site, the potential environmental migration pathways of concern, the identity of concentrations of contaminants at the site, and an evaluation of the need for remedial and/or removal actions at the property. To gather this information and complete a RA, the following tasks are appropriate:

- review of files; reports; well logs; aerial imagery; Sanborn Maps; and U.S. Geological Survey, Soil Conservation Service, and other institutions with geological, hydrological, and topographical data
- conduct a site reconnaissance visit
- conduct geophysical studies especially metal detector surveys to determine the presence or absence of underground storage tanks, buried drums, and/or other buried objects
- determine the presence or absence of asbestos and other materials that may require removal or complicate redevelopment
- screen samples before collection with the TVA and/or Immunoassays
- use the Geoprobe to gather data on site geology and collect groundwater samples
- collect/analyze samples for volatile organic compounds, extractable organic compounds (this includes base/neutral extractables, acid extractables, and pesticides/PCBs), and inorganic compounds.
- collect/analyze soil samples by the TCLP (Toxicity Characteristics Leaching Procedure) method to determine the presence or absence of hazardous waste

A workplan will be sent to the Early Project Managers at USEPA to notify them of the upcoming sampling event. In general, more samples are collected during a redevelopment assessment than during traditional CERCLA activities to assist in characterizing the site.

The Redevelopment Assessments differ from traditional CERCLA activities, however, much of the site investigation is equivalent. The primary difference occurs in the sampling strategy. Sampling is more extensive. All areas of the site are sampled and samples are collected at various depths to get an indication of the depth of contamination. Sampling is confined to on-site, there is generally no target sampling. Furthermore, generally, all applicable screening techniques are utilized at Brownfield sites. Another important difference between traditional CERCLA investigations and Redevelopment Assessment is the interpreting of the analytical results and the final report. The sample analyses are compared to the Illinois Environmental Protection Agency's Tiered Approach to Cleanup Objectives, with consideration of background concentrations, to assist in determining the degree of contamination present on-site. The HRS system is not applied in any manner to these investigations. There is no intent to score the site using the HRS. (Note: These two investigations are similar, but the differences between the traditional CERCLA investigations and Brownfield investigations are identified in the various sections throughout this QAPP).

Completion of the RA will generally include a formal report which will address the site history, operations, waste characteristics, and a discussion of the need for future remedial activities at the site. The report will also include photographic documentation, site and area maps, and a presentation of analytical data. No scoring package will be completed.

If upon completion of the RA it is determined that future site remediation does not appear to be warranted, the State (the Site Assessment Program in cooperation with the Site Remediation Program) will also prepare a NFRAP letter and provide it to the property owner and the appropriate local officials. If however, after completion of the assessment it is determined that there are contaminants present which would require remedial actions, the property owners shall be notified of these findings and encouraged to enroll into the State's Site Remediation Program.

#### Data Usage and Assessment

In the Site Assessment Program, sampling and the associated analytical work are necessary for the Brownfield site RAs. The primary purpose for this analytical work is to complete a site characterization to identify potential impediments to redevelopment. This analytical data may also be of secondary use in future investigations or in relation to public health concerns.

Samples are sent to the USEPA Contract Lab Program or to IEPA labs. Soil, sediment, waste, surface water, and groundwater analyses will all undergo data assessment by Quality Assurance Coordinators and the laboratory managers for the data produced in their laboratories. The data assessment will be done in terms of instrument conditions, initial calibration, continuous

calibration, verification, method blanks, field blanks, matrix spike recovery, duplicate analyses, matrix spike duplicates, surrogate compounds recovery and laboratory control sample analyses. All of the analyses and recoveries must meet the established limits (Refer to the USEPA CLP SOWs). For samples sent to IEPA labs, the IEPA Quality Assurance Section will manually validate the data package prepared by the laboratory equivalent to Contract Lab Program requirements and results will be reported to the Site Assessment staff of the Division of Land Pollution. For samples analyzed through the Contract Lab Program, all data is reviewed by a Computer-Aided Data Review and Evaluation (CADRE) software. The Computer Aided Data Review and Evaluation (CADRE) review provides a quicker turn around time for analytical results. It should be noted that, if needed, a full manual data review can be requested in the future. Data is sent to the USEPA and forwarded to the Site Assessment staff. To further expedite the validation process, no validation is completed for TCLP results because these results are generally used for disposal purposes only. This type of data validation is in line with the purpose of Brownfield investigations as a streamlined assessment to assist in the redevelopment of properties (Refer to Section 8.0).

Site Assessment staff then compare the analyses against the IEPA Tiered Approach to Corrective Action Objectives, background levels, and Subtitle G Subpart C the Characteristics of Hazardous Waste. Any parameter with a value that is greater than these objectives and the background concentration is considered elevated and should be addressed as stated in the Tiered Approach to Corrective Action Objectives document. This analytical data, staff recommendations and conclusions, and reports will be reviewed by the IEPA Site Assessment Program manager. After needed corrections are made the report is transmitted to the community in which the site is located and USEPA, Office of Superfund, Superfund Program Management Branch, Technical Support Section for review.

## **1.6 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA**

The Data Quality Objective (DQO) process is a series of planning steps based on the Scientific Method that is designed to ensure that the type, quality, and quantity of environmental data used in decision making are appropriate for intended application. DQOs are qualitative and quantitative statements derived from outputs of each step of the DQO process that clarify the study objective, define the most appropriate type of data to collect and determine the most appropriate conditions from which to collect the data. The DQOs are then used to develop a scientific and resource effective sampling design.

The DQO process allows decision makers to define their data requirements and acceptable levels of decision during planning before any data is collected. DQOs should be based on the seven step process described in EPA QA/G-4 document (September 1994).

## 2.0 ORGANIZATION AND RESPONSIBILITY

The Site Assessment program requires both field sampling and laboratory analysis. Program management and field sampling is conducted by the Division of Land Pollution Control. Laboratory analysis is the responsibility of the laboratory (either USEPA CLP, CRL or IEPA). The primary source of analysis is the CLP.

Overall quality assurance responsibilities are divided between the manager of the Site Assessment Program within the Division of Land Pollution Control and the Quality Assurance Officer of the Division of Land Pollution Control and the Quality Assurance Officer of the Division of Laboratories. These individuals delegate portions of their quality assurance responsibilities to people reporting to them.

Specific quality assurance responsibilities, with respect to the Site Assessment Program and the Division of Laboratories are defined below.

### Site Assessment Program - Thomas Crause, Manager

Coordinates training programs for all field sampling personnel. General training includes safety, number of samples, sampling strategy, cleanliness of equipment, use of field blanks, etc. This general training is being provided by USEPA.

Informs laboratories in advance when samples will be sent and identify any particular requirements for special treatment when large numbers of special types of samples are to be sent.

Works with the manager of the division of Land Pollution Control to determine the number of samples that can be run under existing funding. Recommend purchase of equipment.

Reviews analytical results with field personnel before release from the division. Work with the laboratories to refine the goals and objectives for precision and accuracy as requested by the Region V QA officer.

Is responsible for submission of this document to USEPA Region 5 and for the preparation of the Bureau of Land's portion of this document.

### Division of Laboratories

Division Manager,

Has overall responsibilities of the IEPA's two laboratories and the Quality Assurance Section.

Quality Assurance Section Manager,

Oversees the preparation of the Division of Laboratories portion of this document. He is in charge of the Quality Assurance Section. He is a link to division of Land Pollution for this project. He is responsible for supervising the validation, by Quality Assurance Section staff, of the data packages generated by the IEPA Division of Laboratories for the proposed NPL site, after it has been assessed by the laboratory.

Divisional Quality Assurance Officer (QAO):

The Divisional QAO has lead responsibility for preparation of this document and works with the Quality Assurance Committee and Senior Management to assure the quality of data generated.

Laboratory Managers and Unit Supervisors:

They have the responsibility to operate the laboratories properly, and assure the validity of the data generated. They act as consultants and trouble shooters in the event complications arise.

Chemists:

They run the instruments and analyze the samples prepared by other chemists or the laboratory associates and assistants. They have overall responsibility of quality assurance. They make sure all the quality control samples are analyzed and the results are within acceptance limits.

Laboratory Quality Assurance Officers:

Each laboratory's QAO has the responsibility of helping the Division Quality Assurance Officer prepare this document and assuring the generation of quality data.

USEPA

EPA Quality Assurance Reviewer has the responsibility to review and approve all Quality Assurance Project Plans (QAPPs). Additional U.S. EPA responsibilities for the Site Assessment Program include:

- Conducting external Performance and System Audits of Laboratory and Field Activities
- Reviewing and approving sampling plans
- Reviewing and evaluating analytical field and laboratory procedures

Responsibilities for additional aspects of the Site Remediation Program when sample analyses are not performed by the IEPA are as follows:

- Scheduling of CLP Analyses

- Scheduling of SAS Analyses
- Data validation of CLP/CRL RAS and SAS including tentatively identified compounds



## 3.0 QUALITY ASSURANCE OBJECTIVES

The overall QA objective for the Site Assessment Program is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide results which are legally defensible in a court of law. Specific procedures for sampling, chain-of-custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal quality control, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP.

### 3.1 Precision

#### 3.1.1 Definition

Precision is a measure of the degree to which two or more measurements are in agreement.

#### 3.1.2 Field Precision Objectives

Field precision is assessed through the collection and measurement of field duplicates at a rate of 1 duplicate per 10 analytical samples. The total number of duplicates for this project are found in Summary Table of Sampling and Analysis Program (Table 1-1).

#### 3.1.3 Laboratory Precision Objectives

Precision in the laboratory is assessed through the calculation of relative percent differences (RPD) and relative standard deviations (RSD) for three or more replicate samples. The equations to be used for precision in this project can be found in section 12 of this QAPP. The precision requirements for the CLP Analytical procedures performed by the Illinois EPA laboratories are specified in USEPA CLP Statement of Work OLM0.3.0 and Statement of Work ILM0.4.0. The precision requirements for CLP Analytical procedures performed by USEPA CLP laboratories or contractors are specified in the current Statement of Work or the Special Analytical Services request.

### 3.2 Accuracy

### **3.2.1 Definition**

Accuracy is the degree of agreement between an observed value and an accepted reference value.

### **3.2.2 Field Accuracy Objectives**

Accuracy in the field is assessed through the use of field and trip blanks and through the adherence to all sample handling, preservation and holding times.

### **3.2.3 Laboratory Accuracy Objectives**

Laboratory accuracy is assessed through the analysis of matrix spikes (MS) or standard reference materials (SRM) and the determination of percent recoveries. The equation to be used for accuracy in this project can be found in section 12 of this QAPP. The accuracy requirements for the CLP Analytical procedures performed by the Illinois EPA laboratories are specified in USEPA CLP Statement of Work OLM03.0, OLC03.2 and Statement of Work ILM04.0. The accuracy requirements for CLP Analytical procedures performed by USEPA CLP laboratories or contractors are specified in the current Statement of Work and table 3-1 or the Special Analytical Services request.

## **3.3 Sensitivity**

The sensitivities required for CLP analyses will be the Contract Required Quantitation Limits shown in Appendix E of this QAPP. The sensitivity requirements for SAS are specified in each individual SAS request.

## **3.4 Representativeness**

### **3.4.1 Definition**

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

### **3.4.2 Measures to Ensure Representativeness of Field Data**

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the field sampling plan (FSP) is followed and that proper sampling techniques are used.

### **3.4.3 Measures to Ensure Representativeness of Laboratory Data**

Representativeness in the laboratory is ensured by using the proper analytical procedures, meeting sample holding times and analyzing and assessing field duplicated samples.

## **3.5 Completeness**

### **3.5.1 Definition**

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions.

### **3.5.2 Field Completeness Objectives**

Field completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. The equation for completeness is presented in Section 12 of this QAPP. Field completeness for this Site Remediation Program varies dependent upon the activity and phase of work (see Section 3).

### **3.5.3 Laboratory Completeness Objectives**

Laboratory completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. The equation for completeness is presented in Section 12 of this QAPP. Laboratory completeness goal for this Site Remediation Program is 95 percent.

## **3.6 Comparability**

### **3.6.1 Definition**

Comparability is an expression of the confidence with which one data set can be compared with another. Comparability is also dependent on similar QA objectives.

### **3.6.2 Measures to Ensure Comparability of Field Data**

Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the FSP is followed and that proper sampling techniques are used.

### **3.6.3 Measures to Ensure Comparability of Laboratory Data**

Planned analytical data will be comparable when similar sampling and analytical methods are used and documented in the QAPP. Comparability is also dependent on similar QA objectives.

## **3.7 Level of Quality Control Effort**

Field blank, trip blank, method blank, duplicate and matrix spike samples will be analyzed to assess the quality of the data resulting from the field sampling and analytical programs. Field and trip blanks should be collected for air and gas samples.

Field and trip blanks consisting of distilled water, will be submitted to the analytical laboratories to provide the means to assess the quality of the data resulting from the field sampling program. Field blank samples are analyzed to check for procedural contamination at the facility which may cause sample contamination. Trip blanks are used to assess the potential for contamination of samples due to contaminant migration during sample shipment and storage. Trip blanks generally pertain to volatile organic samples only. Trip blanks are prepared by the bottle vendor prior to the sampling event in the actual sample containers and are kept with the investigative samples throughout the sampling event. They are then packaged for shipment with other samples and sent for analysis. There should be one trip blank included in each sample shipping container. At no time after their preparation are the sample containers opened before they reach the laboratory.

Method blank samples are generated within the laboratory and used to assess contamination resulting from laboratory procedures. Duplicate samples are analyzed to check for sampling and analytical reproducibility. Matrix spikes provide information about the effect of the sample matrix on the digestion and measurement methodology. All matrix spikes are performed in duplicate and

are hereinafter referred to as MS/MSD samples. One matrix spike/matrix spike duplicate will be collected for every 20 or fewer investigative samples. MS/MSD samples are designated/ collected for organic analyses only.

MS/MSD samples are investigative samples. Soil MS/MSD samples require no extra volume for extractable organics although the number of encore tubes needs to be doubled when sampling for soil VOC MS/MSD. However, aqueous MS/MSD samples must be collected at triple the volume for VOCs and double the volume for extractable organics. One MS/MSD sample will be collected/designated for every 20 or fewer investigative samples per sample matrix (i.e., groundwater, soil). Chain of Custody needs to clearly specify which sample is used for MS/MSD.

The general level of the QC effort will be one field duplicate and one field blank for every 10 or fewer investigative samples. One volatile organic analysis (VOA) trip blank consisting of distilled deionized ultra pure water will be included along with each shipment of aqueous VOA samples.

## 4.0 SAMPLING PROCEDURES

### 4.1 INTRODUCTION

There are a variety of documents providing guidance specifically dedicated to sampling at hazardous substance sites. This section contains a compilation of general information about sampling followed by specific information for sampling different media. Through a cooperative effort by representatives of the various sections and units of the IEPA Bureau of Land, the Bureau of Land Sampling Procedures Guidance Manual was developed. This manual consists of sampling procedures for a variety of media and situations. The sampling procedures outlined in this manual are the compilation of methods which are described in a variety of sampling documents. A list of references follows each section in the manual.

The objective of sampling is to acquire data which will assist personnel in determining:

- the identification of the hazardous substances present at a site (IA, STEP, ESI, RA)
- the occurrence and extent of hazardous substance migration (IA, STEP, ESI, RA)
- the HRS score (IA, STEP, ESI)

- the presence of contamination at targets (IA, STEP, ESI)
- the nature and depth of contamination (RA)
- the characterization of the waste for disposal (RA)

The data generated from analysis of samples collected during traditional CERCLA investigations often provides a crucial portion of the evidence used in subsequent litigation and may further be used in the development of appropriate remedial action alternatives. Furthermore, in the case of Redevelopment Assessments, sample analysis also provide an idea of the contamination present in relation to the redevelopment potential of the property. Therefore, certain procedures should be followed to provide the best information possible. In addition, careful selection of sampling locations and methods also helps reduce the costs of labor and analytical support.

The following sections contain general sampling information and specific procedural information.

## **4.2 SAMPLING STRATEGY**

The sampling strategy utilized is important in acquiring the type of information needed and accomplishing the objectives of the investigation. Traditional CERCLA sites normally are sampled to provide data for HRS, support enforcement, or characterize the site for remedial work. Brownfield sites normally are sampled to assist in determining the redevelopment potential of the property by describing the contamination present. These tasks entail different sampling goals and strategies. Therefore, the design of the sampling strategy must ensure that the samples obtained will meet the goals of the specific investigation.

For enforcement and HRS scoring it is not necessary to identify all of the hazardous substances or areas of migration. The general strategy is to sample those areas or containers most likely to give positive evidence of the most hazardous contamination or chemical suspected to be present. Similarly, to demonstrate off-site migration, those areas where off-site migration is most probable are sampled first. Thus, containers to be sampled for evidence of hazardous chemicals are generally selected on the basis of drum markings or other information indicating hazardous contents. Stream sediments are sampled in locations of heavy stream deposition, and stream water samples are collected nearest the point of suspected contaminant entry. Therefore, a biased sampling approach is used for both legal support and HRS scoring. This approach is contrary to most established sampling procedures which stress the importance of selecting sampling points without bias. Furthermore, for site investigations in support of remedial design, thoroughness in total site characterization is desirable. In such cases, statistically acceptable random sampling techniques should be used if possible to minimize sample numbers.

For Brownfield RAs, a combination of the above methods are employed. Sampling activities are designed to identify potential areas of concern and to determine if these areas pose a risk to human

health and/or the environment. The general strategy is to sample areas of concern which is the same strategy employed at traditional CERCLA sites. RAs also should characterize the entire site, meaning that samples should be spread around the site cover all of the different areas. Depending on the information available, areas of concern will be targeted and the entire area will be adequately sampled. In some instances, a grid approach to sampling may be used. Generally, samples are collected from the most contaminated interval and from the deepest interval that appears to be clean.

### **4.3. TYPES OF SAMPLES**

#### **4.3.1 ENVIRONMENTAL SAMPLES**

Environmental samples are normally dilute and do not require the special shipping procedures used with concentrated samples. (Refer to Section 4.12 for shipping instructions) If there is reason to believe that particular environmental samples are concentrated or particularly hazardous for any other reason, they should be shipped as hazardous samples.

#### **4.3.2 HAZARDOUS SAMPLES**

These include on-site samples obtained from surface impoundments (lagoons), pits, waste piles and containers, including drums, tanks, and tank cars. Based upon the best professional judgement of field personnel, these types of samples may be sub-categorized as either high-or medium-concentration samples (Refer to Section 4.12 for shipping instructions).

High-concentration hazardous samples include all samples that have no obvious and significant dilution with water, soil, or any other non-toxic component. Generally these samples are from containers or fresh spills. Obtaining these samples poses the greatest risk of exposure to personnel. In addition, U.S. Department of Transportation (DOT) regulations require that samples be shipped under "worst case" conditions. The samples should be conveyed to a regulated substances laboratory where they may be safely prepared for further analysis. The CLP does not analyze high concentration hazardous samples. If high concentration hazardous samples need to be analyzed a special request for analytical services needs to be made.

Medium-concentration hazardous samples are environmental samples suspected of being heavily contaminated because they are discolored, turbid, odorous, or from a location suspected to be highly concentrated (spill location). These samples are shipped in the same manner as high concentration samples, but should be analyzed only in an environmental laboratory equipped with an OSHA-approved carcinogen glove box (Policy of EPA for contract laboratories).

#### **4.4 GENERAL SAMPLING TECHNIQUES**

Two types of sampling techniques are generally recognized: grab sampling and composite sampling (Refer to Sections 4.7, 4.8, and 4.9 for specific applications). A grab sample is taken over a short period of time, generally less than 15 minutes. Grab sampling is used to characterize wastes, waste streams, soils and/or sediments at a given time. Grab sampling is frequently employed for hazardous substance site investigations including CERCLA and Brownfield investigations.

A composite sample is a combination of individual samples taken over a prolonged period of time at the same sampling point. This technique is not frequently used in hazardous site investigations; however, a modification of composite sampling may be used in certain instances. This modification involves combining samples taken at different locations (pond, lagoon, etc.) into one sample. This provides a sample composited by location rather than time and may provide useful data on the average concentration of contaminants or the presence or absence of hazardous substances in the area. Samples used for volatile organic compound analysis must be grab samples rather than composite samples. Soil samples for volatile analysis are collected using the encore sampler. In general, VOC are collected before sampling other parameters.

#### **4.5 WORK PLAN**

Site inspections require a work plan which describes the scope of work, details the methodologies to be utilized, and also includes safety procedures to be followed. A work plan can be adjusted to suit the activities of the specific investigation, but it should always contain the following elements:

- statement of objectives and goals of the investigation
- site description and summary of background and historical information on the site and a reference to legal authority to perform the investigation
- investigation methods required to characterize the site including a sampling plan that indicates sample types, sampling locations, sampling procedures and equipment, and field quality control
- personnel requirements and team organization
- degree of protective clothing and equipment required as determined by the potential for exposure and the hazardous nature of the suspected contaminants as described in the safety plan



- emergency numbers and locations of emergency facilities
- nonstandard equipment or contract services which may be needed to complete the investigation
- methods used to control contaminated materials, including decontamination procedures and storage or disposal requirements including RCRA manifest number for removal if designated hazardous
- special training requirements

As this list indicates, the work plan allows the investigation team to efficiently schedule such resources as manpower, equipment, and laboratory services in advance of an investigation. The work plan is thus an essential tool in the investigation of hazardous substance sites.

#### **4.5.1 SAMPLING PLAN**

As part of the work plan for a field investigation that involves sampling, a sampling plan should be developed that includes the types and number of samples to be taken and the locations of sampling points. It is recommended that a brief rationale be written for each selected type of sample and sampling point chosen. This process will help focus the sample selection on the objective of the field investigation and will help investigators select those points likely to be representative of hazardous conditions. The importance of using all background and historical information available to assist in the development of the plan cannot be stressed enough.

The sampling plan should address, but not necessarily be limited to, the following elements:

number of samples to be taken Factors affecting the number of samples required include the area of the site and sampling goals. In general, a small number of samples are required to establish contaminant concentration ranges for traditional CERCLA investigations. Average concentrations are sufficient for enforcement cases, while concentration ranges are necessary for remedial work. For Brownfield Redevelopment Assessments, a larger number of samples are necessary to characterize the entire site and the nature and depths of contamination present.

selection of background sampling points Sampling points beyond the limits of site contamination, e.g., upwind ambient air samples or upstream surface water samples, should be identified. This is essential in enforcement cases in order to document environmental quality in the immediate vicinity that has not been affected by contaminants on the site.

sample containers, preservation techniques, sample equipment and field measurement devices Refer to Sections 4.7 through 4.11.

sample documentation The sample tags, chain-of-custody forms, field logbooks and photographic equipment necessary to document the sampling process should be prepared (Refer to Section 4.10).

quality control The number and locations where duplicate samples will taken for quality control should be identified. The number of field blanks should also be indicated and prepared. Trip blanks are required for samples collected for volatile organic compound analysis. One trip blank is required per shipping container. One field blank should be collected per ten investigative samples.

split samples Preparation should be made to split samples with site/facility representatives if requested.

analytical services The analyses which will be requested for the samples, based on background information should be identified, and the laboratory facilities which will receive the samples should be notified.

sample packaging and shipping Refer to Section 4.12

The most commonly requested analyses are for the substances of the Target Compound List (TCL) and the Target Analyte List (TAL). These lists include substances which are used in a wide range of industrial applications, whose presence in the environment has been linked to health-related effects, and often are found at Superfund sites. The TCL list includes volatile organic compounds and extractable organic compounds (this includes base/neutral extractables, acid extractables, and pesticides/PCBs). The TAL includes inorganic compounds (metals and cyanide). A copy of the lists are provided in Appendix E. It is common to conduct analyses on parts of the lists depending on previous analytical data and site information that is available. In addition to these above analytical methods, TCLP are also conducted on metals as part of Brownfield investigations. This analysis provides to determine the presence of hazardous waste and, therefore, information on the method of disposal solid waste as defined in Title 35 Subtitle G of the Illinois Environmental Protection Act.

Even though the Target Compound List and the Target Analyte List are the norm for both traditional CERCLA investigations and Brownfield investigations, other analyses may be requested as site-specific information becomes available. For example, dioxin and asbestos analyses may be necessary. Such analyses are requested through Region V and the SAS process.

Quality control samples are also collected at all sites. It is important to maintain good field sampling methods to prevent cross contamination and provide for accurate analytical results.

Generally, one duplicate is taken per matrix for every ten samples, one trip blank is taken per day, and one field blank per 20 samples is collected. These quality control samples are analyzed for the same compounds and analytes and by the same methods as described above. The only exception to this is that the trip blank is only analyzed for volatile organic compounds. Laboratory blanks and spikes are method-specific and are not included here, but are included in the USEPA CLP SOWs. Representative field sampling is important; pH, temperature and conductivity stabilization is crucial for representative groundwater samples as well as homogenization of soil sample after VOCs are taken.

#### **4.5.2 SAFETY PLAN**

A safety plan should be prepared to an investigation requiring sampling. It is important the safety plan be kept on-site and easily accessible. It is necessary that the safety plan anticipate and provide for problems that may occur on-site. The IEPA Office of Chemical Safety reviews all safety plans before on-site investigations begin.

A safety plan can be adjusted to suit the activities of the specific investigation, but it should always contain the following elements:

- site description and summary of background and historical information on the site  
personnel requirements and team organization
- investigation tasks including the method of sample collection and the sample media
- degree of protective clothing and equipment required as determined by the potential for exposure and the hazardous nature of the suspected contaminants for each task
- degree of air monitoring
- action levels for upgrading protective clothing and equipment
- chemical properties, symptoms of overexposure, and exposure limits for chemicals suspected to be present or known to be present on-site
- employee training

emergency numbers, locations, and directions of emergency facilities

#### **4.6 FIELD SCREENING TECHNIQUES**

Influenced by the newly undertaken Brownfield investigations and in order to provide the most

and best information from sampling additional screening techniques are conducted at sites. These techniques are employed during both traditional CERCLA investigations as well as during Brownfield investigations.

Screening techniques are employed for several purposes including screening the site to determine the level of safety required for personnel working at the site, to determine which compounds or groups of compounds are of concern, and to assist in sample location. Air monitoring equipment should be used as described in the safety plan to protect personnel working on-site. Screening samples can assist in determining which analytical compounds are of possible concern. Also, screening samples before collection assists in sample location so that samples are collected from areas of suspected contamination and not collected from areas in which screening reveal no contamination. Both of these screening techniques assist in reducing laboratory costs and maximizing the information obtained from each sample and screening location.

#### **4.6.1 TOXIC VAPOR ANALYZER (TVA)**

The Agency utilizes Foxboro TVA-1000 Toxic Vapor Analyzers for ambient air monitoring situations. The TVA-1000 is an advanced-design, portable, organic/inorganic vapor monitor. This analyzer uses both a flame ionization detector (FID) and a photoionization detector (PID) to sample and measure concentrations of gases. The Toxic Vapor Analyzer instrument continuously monitors the ambient atmosphere. The two detectors each have different methods of detecting organic vapors, ionization potential and hydrogen flame. Because this instrument has both detectors combined in a single unit, it allows for the screening of a wide variety of compounds. This instrument responds to all organic vapors and is nonselective. It responds to toxic and non-toxic vapors and cannot identify specific compounds. This instrument is used for both health and safety monitoring as well as sample screening. All Agency TVA's are calibrated at the equipment warehouse by a Foxboro Company-trained individual. Calibration is completed prior to each instrument's use in the field. The TVA's PID's are calibrated with isobutylene, the FID's with methane. Both can be calibrated to either parts per million (PPM), parts per billion (PPB), or percent concentration (%). In the field, however, in many instances, the type of gases or vapors encountered are unknown so readings cannot be referred to in ppm, ppb, or %. Therefore, readings are referred to in "units".

The instruments instruction manual, included in each protective carrying case, describes start-up procedures; instrument and probe connections, displays, and keypads; procedures for calibrating the TVA, setting alarm levels, selecting log methods, and instrument maintenance, etc. These instructions will be followed and adhered to by all operating personnel.

Generally, air monitoring is required wherever the possibility of exposure to hazardous substances exists. The frequency, type of air monitoring, and type of air monitoring instrumentation necessary to protect personnel is specified in the Site Safety Plan completed by all field personnel prior to their site visit. TVA readings are utilized to upgrade or downgrade respiratory protection.

In addition to protection of personnel, the TVA is used in conjunction with sampling of soil and groundwater and in soil gas sampling when used with the Agency's Geoprobe. The TVA can be used for screening potential soil sample locations and screening samples as they are being collected. Soil in potential sample locations or predesignated locations can be exposed thereby allowing VOC's to be released to the air and sampled by the TVA. Locations with the highest TVA reading would then be formally sampled. The following soil sample screening method is applicable at both traditional CERCLA investigations and Redevelopment Assessment investigations to determine, in general, extent and depth of contamination. Soil samples or screening samples obtained utilizing a hand auger or through the use of the Agency's Geoprobe are screened using the same method. Using a hand auger, soil recovered from a certain horizon is removed from the auger and placed in a clean airtight plastic bag. The bag is then placed in a warm place for approximately fifteen minutes to allow volatilization of organic compounds that may be present in the soil. After the fifteen minutes, a TVA probe is inserted into the plastic bag. Photoionization and Flame Ionization Detector readings are recorded for each bag. This screening process is repeated for each bag collected from the various horizons at each potential sample location. These readings are used to assist in determining the depth at which to collect samples. When utilizing the Geoprobe for obtaining samples or screening samples, four foot cores are obtained via a polypropylene sleeve inserted within a Macro-Core sampling tube which has been driven hydraulically to depth then brought to the surface. The sleeve is then removed from the Macro-Core assembly and cut vertically to allow access to the soil. The cut portion of the sleeve is kept intact until the TVA probe is brought to the horizon of concern. The cut portion of the sleeve is then removed, a small cavity is created in the soil at the specific location where screening is to take place and the TVA probe is carefully inserted into this cavity, being careful not to contact the soil itself or allow any material to be sucked into the probe. Readings can be quickly taken at a number of locations in each sleeve obtained. The TVA is also used during soil boring work as a screening device for air monitoring in the breathing zone and at the soil surface for measurement of possible contaminants emanating from the borehole. As borings are advanced the TVA probe is placed in the breathing zone of the individuals operating the boring equipment. Readings are on a continual basis. Screening associated with measurements of the borehole at the soil surface are conducted by placing the TVA probe carefully into the opening of the borehole. In this manor, readings can be obtained from approximately one foot below surface grade.

Soil gas sampling for screening purposes can be accomplished above the saturated zone through use of the TVA in conjunction with the Geoprobe. With 1/4 inch inside diameter size 6 polyethylene tubing attached to the TVA's probe and to the probe rod, it is possible to sample soil gas through probe rods using, either, an expendable or retractable point. This is completed by advancing the point and probe rods to a specified depth, retracting the probe rods slightly, and either leaving the expendable point in place or allowing the retractable point to deploy thereby allowing soil gas to enter the open lower end of the probe rod. The gas then travels to the TVA via the poly tubing attached to the first probe rod on the rod string. Lag time from depth to the TVA depends on the length of tubing being used. If drawing soil gas samples from near the water

table, care must be taken not to introduce moisture into the unit.

The TVA is also used to screen the area around monitor wells, the air space adjacent to the monitoring well's protective casing and the head space of the monitoring well as the well cap is slightly lifted prior to completely removing the cap. When approaching a monitoring well, the TVA will be used to screen the ambient air near the well, both, near ground level and in the breathing zone. When at a monitoring well, a screening of the air immediately adjacent to the wells protective casing will be completed prior to unlocking the cover of the casing. Once the cover is unlocked and slightly opened, the probe of the TVA is placed at the opening and used to screen air inside the casing. When the cover is completely open, the probe of the TVA is placed adjacent to the well's cap and used to screen air at this location for possible vapor emanating from the air space inside the well. The cap would then be lifted slightly and the probe placed into the head space of the well thereby screening for accumulated vapor. While sampling the groundwater from a well the TVA is used to continuously monitor ambient air and the breathing zone area.

The instrument can be set up to be operated either as survey only, in which the instrument displays measured values but does not store any data, or survey and log, in which the instrument displays measured values and also stores the information in memory at a rate selected during setup. Information may then be downloaded at a future time for further analysis.

#### **4.6.2 IMMUNOASSAYS**

Immunoassays are analytical methods that use antibodies and enzyme conjugates to detect and quantify chemical compounds in a sample. Immunoassays rely on a molecule referred to as an antibody that is developed to have a high degree of affinity for the target compound. The high specificity and high affinity of the antibody is coupled with a very sensitive colorimetric reaction that provides a visual result. There are immunoassay methods available for a variety of compounds including polychlorinated biphenyls, polynuclear aromatic hydrocarbons, benzene, dioxin, pentachlorophenol, and petroleum hydrocarbons. Immunoassay screening can be conducted at sites to assist in determining the presence of contamination, to assist in determining which compounds to select for analytical analyses, and to assist in determining sample locations.

Immunoassay screening can be conducted on soil and groundwater samples and is applicable at Brownfield investigations as well as traditional CERCLA investigations. Generally, the immunoassay methods consist of four phases: the extraction and preparation of the samples, dilution of samples and standards, the immunoassay, and interpretation of results. Every kit contains everything that is needed to conduct the immunoassay as well as detailed step-by-step instructions. The results are utilized to determine if contamination is present, which type of contaminants are present, and where samples should be collected.

#### **4.6.3 METAL DETECTOR SURVEYS**

Geophysical surveys in the form of metal detector surveys are conducted in conjunction with the assistance of the USEPA Technical Support Section. The purpose of these surveys is to investigate and determine the presence of metallic scrap or underground tanks. The Geonics High-Sensitivity Metal Detector, commonly known as an EM61, generates electromagnetic pulses and measures the response time to determine the presence of metal beneath the surface. A map can then be produced.

These surveys are very beneficial to Brownfield investigations. The surveys are used to determine the presence or possible presence of an underground tank. The presence or absence of underground tanks are important to the redevelopment potential of properties. Also, the information generated from these surveys can assist in determining potential sample locations and assist in identifying areas where caution is necessary when digging. Even though these metal detector surveys have evident advantages For Brownfield investigations, the surveys also can be beneficial to specific traditional CERCLA investigations.

#### **4.6.4 X-RAY FLUORESCENCE ANALYZER**

The Niton 700 Series X-Ray Fluorescence (XRF) is used to test for metals in soil. Applications include in-situ soil testing, bagged soil sample testing and testing prepared soil samples. In general, testing methods for bulk media are of two types: field screening (or in-situ testing, bagged sample testing) and testing prepared samples. It is important to understand your data quality objectives (DQO) in order to determine the appropriate mix of field screening versus prepared sample testing.

In-situ testing usually only provides screening level data quality. This is because analytical testing always requires a uniform, homogeneous sample matrix. Testing directly on the ground does not ensure this requirement is met. Despite generally providing screening level data quality, in-situ testing is still a very valuable technique because it is a very rapid testing method. Typical uses of in-situ testing are to profile an area, to locate sources of contamination, to determine the boundaries of contamination, or to gather data that will subsequently be used to design a sampling plan.

##### **Standard Operating Procedure**

This procedure follows US EPA draft Method 6200 "Testing Soils and Sediments with field Portable X-ray Fluorescence Analyzers." It addresses calibration checks, proper warmup of the instrument and testing of blank samples.

Turn on instrument for 15 minutes prior to calibration and testing, to allow proper warmup.

1. Choose the Bulk Sample mode from the Setup screen.
2. Choose "Calibrate and Test" from the Main Menu. In about 1 minute the instrument will finish its self-calibration, and display "ready to test".
3. Place a NIST "high" prepared soil sample in the testing platform and perform a one minute measurement.  
(Note: For verifying arsenic calibration, the recommended testing time is four minutes. If you don't require arsenic verification, then perform a one-minute test only).
4. At the conclusion of the test, verify that results for the following elements are within the acceptance ranges shown in Table 1 below.
5. Place the silicon-dioxide sample (blank) in the test stand and perform a one minute test. At the conclusion of the test, all elements should be reported as "less that limit of detection."

Table 1  
Calibration ranges for 700 Series calibration checks

Element	Range (ppm)
Lead	5,100 to 5,900
Zinc	6,300 to 7,500
Copper	2,400 to 3,500
Arsenic	500 to 750

Failure to meet these calibration requirements may indicate a problem with the instrument. If any of the elements are outside these ranges, reset the instrument and repeat the above procedure. If the instrument meets the calibration range on the second attempt, begin testing as usual. Otherwise contact NITON technical support for further instructions.

Provided the XRF meets the above calibration check, but reports a detected element on the silicon dioxide sample, this indicates contamination on the sampling window. In this case, wipe down window with a wet tissue or baby wipe, and re-test the silicon dioxide sample.

This re-calibration and check procedure should be repeated every two hours at a minimum. This procedure should always be performed at the beginning and end of testing as well.

It is always good protocol to perform some independent confirmatory testing of field sampling. The percentage of confirmation depends on the data quality objectives of the testing. In general, the percentages outlined above are satisfactory for most testing.



For comparison of field XRF results to laboratory, never use in-situ testing; always gather samples and prepare them before testing. Follow the sample preparation protocol provided above. Send the same sample analyzed by the XRF to the laboratory for analysis. If you must retain the sample, then try to split the sample analyzed with XRF, and send a portion of this to the laboratory.

### **Analysis of bagged bulk samples**

Sometimes it is convenient to collect samples in plastic bags. Without further preparation of the sample, you can screen the site by testing each bag. Because you are testing through a bag, test results will tend to be 5–10% lower than test results obtained from direct analysis.

#### Taking bagged samples

1. Before sampling a site, size it up for differences in soil characteristics. Valid results depend on a sufficient and appropriate selection of sites to sample. Consider the site's topography, texture, drainage, color of topsoil, and past use.
2. Take a composite sample from each predetermined area. Do not combine samples from areas with different compositions or history. A composite sample made up of samplings from two distinctly different areas is not representative of either area.

Mix the sample. If it is too large, reduce the sample. Some techniques for reduction and homogenization are described in the section on analysis of prepared samples.

3. Fill a clean plastic bag with 50–100 grams of soil and close it securely. The accuracy of your measurements will be limited by the thickness of the plastic in the bag you use. 1 mil-thick Polyethylene bags offer a reasonable compromise between accurate readings and bag durability. Label each bag with your name and the location of the sample site.

#### Testing samples in bags

Shape the bag of soil to form a continuous uniform layer of at least 1 cm. (0.4 inch) thickness. Place the XRF test guard on the bag. Then follow testing in-situ instructions.

For safety reasons, do not hold bagged bulk samples in your hand during testing. **Analysis of prepared bulk samples**

Prepared sample analysis is the most accurate method for determining the concentration of elements in a bulk medium using the XRF. Sample preparation will minimize the effects of moisture, large particle size and variations in particle size.

A specific sample protocol is recommended. Following this protocol for preparing and testing samples is vital for achieving a level of accuracy comparable with laboratory results. See Figure 3 for a flow chart of the protocol.

### Preparing bulk samples

The equipment need to prepare samples is included in the XRF kit. Among these are a mortar and pestle, an electrically powered grinding mill, and several sized-sieves. A flow chart for the preparation protocol is provided in Figure 3.

The mortar, pestle, and grinding mill may be cleaned with dry paper towels. Water will also clean the mortar, pestle, and the mill's container, but be sure each is absolutely dry before you use them on another sample. The mortar and pestle may be cleansed by grinding clean dry sand in the mortar. Use the short bristle brushes to clean the sieves. When Soil Grinder blades wear out, unbolt the worn blades and replace. **Protocol to Determine Data Quality of In-situ Testing:**

The purpose of this protocol is to determine the amount of sample preparation required to get quantitative, as opposed to screening level data quality. In general quantitative data quality requires an accuracy of  $\pm 25\%$  with 95% confidence. It is beneficial to minimize sample preparation when justified. This procedure serves as a guide to cases where sample preparation can be minimized.

Delineate a region of soil approximately 4" x 4".

Perform several in-situ tests in this area, and average the results.

Collect the top (approximately) quarter inch of soil from this region and sieve through the 2 mm sieve provided. Thoroughly mix the sieved sample, and place some of the sieved material into an XRF cup, and perform a test of this sample.

If the results of this prepared sample differ less than 20% with the average in-situ result, this indicates the soil in this region is reasonably homogenous. The data quality in this case is probably at the semi-quantitative level, rather than just screening data.

If the results differ by more than 20%, this indicates the soil is not very homogeneous, and there are serious particle size effects affecting your in-situ measurements.

In this case, sieve the sample through the 250  $\mu\text{m}$  sieve. Mix this sample and place a sub-sample into an XRF cup for testing. If this result differs from the previous by less than 20% then this indicates that at a minimum the 2mm sieving is necessary to achieve higher data quality.

If this result differs by more than 20% from the sample sieved through 2 mm, then particle size effects are still affecting the XRF result. In this case samples should be sieved through 120  $\mu\text{m}$  to assure data quality at the quantitative level. In our experience, sieving through 120  $\mu\text{m}$  is always adequate to assure a quantitative data quality level.

### **Soil Sample Preparation Protocol**

Fig. 3. Soil sample preparation protocol. This sample preparation protocol should be followed

whenever you are comparing XRF results to laboratory results. Following this protocol is the only way to guarantee that the samples being compared have approximately the same level of contamination present. Without such a preparation protocol there is no basis to compare XRF and laboratory results.

## **4.7 WATER SAMPLING METHODS FOR FIELD INVESTIGATIONS**

The sampling and analysis of surface water and groundwater are major focal points For a large number of field investigations of hazardous substance sites. Surface water and groundwater samples may be necessary to help establish the existence of contamination. Traditional CERCLA investigations collect groundwater and surface water samples to identify contamination and to determine migration of contamination to targets. For traditional investigations, the analysis of a sample taken off-site maybe the initial indicator that the site is a pollution source. Such data helps investigators identify populations at risk and determine appropriate remedial actions. Groundwater samples are collected at Brownfield sites to determine the existence and extent of contamination and to further determine if groundwater remediation is necessary depending on the redevelopment land use. Surface water samples are generally not collected unless a surface water body is directly adjacent or is located on site because these investigations are generally limited to on-site sampling.

Surface water and groundwater samples are usually considered environmental samples, as defined in Section 4.3.1. There are instances, however, when surface water and groundwater samples may be more highly concentrated, even to the degree that they may be considered hazardous samples. The site project manager must decide how such samples should be handled. Visual indicators of high concentrations include coloration, turbidity, odor, multiphasic layering and spontaneous formation of precipitates. Field instruments should also be used for this evaluation.

### **4.7.1 SURFACE WATER SAMPLING**

#### **4.7.1.1 SAMPLING LOCATIONS**

Prior to sampling, the surface water drainage in and around a site should be characterized using all available background information, including topographic maps and river basin studies. The down stream sample is collected first and then work upstream. Air photos may be used to develop drainage maps which can then be confirmed by initial survey of

the surface water adjacent to or on a site. An initial survey of potential sampling points is essential to the development of a sampling plan. Further, it is possible to anticipate any special equipment or personnel safety requirements which might be necessitated by terrain or other factors. The initial survey also allows field personnel to identify landmarks which locate sampling points--a crucial step in maintaining documentation of activities for legal actions.

In general, sampling locations include rivers, brooks or streams running through or adjacent to a site, including those bodies of water which may receive surface runoff or leachate from a site. Discretion is advised in sampling leachate breakouts, which may have concentrations of contaminants. Leachate is formed by the mixing of rain water with wastes buried in the ground. The leachate may then enter groundwater, where it may remain below the ground surface. In areas where the ground surface slopes steeply away from the buried wastes, the leachate may "break out" or emerge on the ground surface. This is referred to as a leachate breakout and is typically encountered at landfills. Samples taken from leachate streams may have to be treated as medium or high concentration samples depending upon a field evaluation. Other surface water sampling locations include any adjacent standing bodies of water such as ponds, lakes or swamps which might be receiving contaminants. (Again, care must be taken in judging the nature of samples taken from on-site surface impoundments if high concentrations are indicated).

It is also essential to establish the quality of water prior to its contact with the site. Surface drainage patterns should be carefully studied to determine background sampling locations. A minimum of one upstream sample is required for streams, although a background sample should be taken from each surface water source which is a on-site tributary to the primary stream. For standing bodies of water, a background sample may be obtained from a similar water body away from the suspected point-source discharge.

Surface water sample locations are dependent upon the type of investigation. Surface water sampling locations for traditional CERCLA investigations are generally selected on the basis of the probability they will show contaminants migrating from a site. The most representative samples in a well-mixed stream are obtained from mid-channel at 0.6 stream depth. For HRS scoring purposes, however, samples should be taken from the mixing zone or areas which are most likely to show contamination. Most these samples are grab samples (Refer to Section 4.4). Surface water bodies will generally not be sampled during Brownfield investigations unless the water body is located on-site. If a surface water body is located on-site, appropriate sampling locations are also selected on the most probable location of impact. As was stated previously, Brownfield investigations are limited to on-site sampling.

The number of sampling locations is dependent on a variety of factors, including the size of a site, the availability of analytical support, and the objectives of the investigation. A recommended absolute minimum would be two locations, including one background location. Ideally, additional locations should be sampled, with some locations selected for taking a duplicate sample, which improves the quality control of the analytical data.

#### **4.7.1.2 SAMPLING PROCEDURES**

A wide variety of information is available on sample collection. The IEPA Bureau of Land has reviewed and compiled this information into a step by step manual on how to collect samples. Refer to Appendix C, the IEPA Bureau of Land Sampling Procedures Guidance Manual, For the specific procedure to collect surface water and leachate samples.

### **4.7.2 GROUNDWATER SAMPLING**

#### **4.7.2.1 SAMPLING LOCATIONS**

Existing monitoring wells should be sampled and analyzed first. This will establish the nature of any contaminants in the groundwater and assist in determining the need for additional well sampling. If analytical data for the monitoring wells already exists, this should be evaluated with the other site-specific information to determine the need for sampling private wells farther away from the site. Existing data may also enable the investigative team to key on a particular type of contaminant, and thus the amount of analytical support required can be reduced. However, before monitoring wells at a hazardous substance site are sampled, the placement of each well should be carefully evaluated for its potential of producing a highly concentrated sample. Such samples require attention to personnel protection and may require the use of respirators. Also, it may be necessary to ship concentrated samples to a laboratory capable of handling hazardous samples.

It is important to locate a well or wells to provide a background (upgradient) groundwater sample. This may be accomplished by studying available hydrological data about the direction of groundwater flow near a site, but may require the use of geophysical techniques and the installation of additional monitoring wells.

The obvious location of groundwater sampling locations for Brownfield investigations are

monitoring wells if they are present. More often than not monitoring wells are not present, and groundwater samples are collected from beneath the site with power equipment. Groundwater samples are collected during these investigations as follows: one or more samples directly below or down gradient of areas of concern (e.g. former location of a dry cleaner, etc.) and one in an up gradient area. These samples are collected with the use of a Geoprobe or a back hoe (Refer to Section 4.9). Again, Brownfield investigations generally collect samples only from the site. Therefore, no residential samples from private wells or municipal wells will be collected.

#### **4.7.2.2 SAMPLING PROCEDURES**

A wide variety of information is available on sample collection. The IEPA Bureau of Land has reviewed and compiled this information into a step by step manual on how to collect samples. Refer to Appendix C, the IEPA Bureau of Land Sampling Procedures Guidance Manual, For the specific procedure to collect groundwater samples from monitoring wells and private or residential wells. Groundwater samples may also be collected with the Geoprobe. The procedure for collecting a groundwater sample using the Geoprobe is also contained in Appendix C. Since the completion of this manual the USEPA has decided to implement new guidance. This guidance endorses using low flow sampling methods and not filtering the sample unless absolutely necessary. This document has been attached in Appendix D for easy reference.

#### **4.8 SOIL AND SEDIMENT SAMPLING METHODS**

The analysis of soil and sediment present at a site can provide valuable information about the existence and extent of contaminant migration. Vertical contaminant movement may occur through soil strata into the groundwater resulting in the lateral transport of pollutants. Surface water can transport contaminants directly or as bound complexes with soil or other solids.

Many of the soil and sediment samples taken during the field investigation to determine the presence of contamination and/or the migration of contamination are grab samples. (Refer to Section 4.4 for a definition of types of samples.) However, it is possible to use a modification of composite sampling to obtain useful data about contamination over a wide area and still control analytical costs.

It is important that field personnel determine whether soil or sediment samples require handling as hazardous (concentrated) or environmental samples. Factors such as weathering and dilution of

soil by sun and rain turbulence of surface water, and permeability of soil will affect the concentration of contaminants in a given sample.

#### **4.8.1 SOIL SAMPLING**

##### **4.8.1.1 SAMPLING LOCATIONS**

Surface and subsurface samples may be used not only to identify contaminants, but also to evaluate the role of soil types in influencing the migration of contaminants. Generally, for both traditional CERCLA investigations and Brownfield investigations, surface soil samples are collected from areas where spills and/or leaks of contaminants may have occurred or in locations where the potential for contamination is high (i.e. next to building locations, loading areas, tanks, etc.). Investigators can determine these areas can be determined from site records or photographs or on direct observation of stained soils or areas lacking vegetation. However, oftentimes at Brownfield investigations sample locations are also selected based on the concept of sampling to characterize the entire site, especially if grid sampling is conducted. In this case, all sample locations may not be selected based on evidence of previous contamination. (It should be noted, however, that in all instances samples will be collected from the depth at each sample location that revealed potential contamination through field screening).

As in any sampling program, it is advisable to obtain an off-site, theoretically uncontaminated surface soil sample to establish background levels of analyzed chemicals. This is especially important if contamination with heavy metals is suspected because they occur naturally.

##### **Approach For Surface Samples**

Depending on the area to be sampled, the information desired and the analytical support available, investigators may take several approaches. First, the total area of study may be divided into a grid pattern to identify samples with a specific location. Second, if the area of study is large, and if complete characterization is required, a random sampling approach may be used to reduce sample numbers. In this instance, the area is grid and sample locations are determined randomly. Low areas, discolored areas or odorous areas may be the best sampling locations. Third, a large study area can also be divided into grids and soil combined from several randomly chosen locations within that grid. This soil then constitutes one sample. The first two grid sampling techniques are commonly employed at large Brownfield investigations. However, for HRS sampling, only the top two feet of soil and those samples which tend to maximize the score are collected.

Any combination of the above approaches may be employed to characterize contamination over a large area. The number of samples required to produce statistically valid data is impossible to determine beforehand since it depends on the variability in the analytical results. In certain instances a small-scale sampling program may be required to estimate data variability.

### Sampling Approach For Subsurface Soil Samples

Subsurface soil samples indicate the extent of contaminant penetration into the soil and also provide a means to evaluate the effect of soil type distribution on contaminant migration. Either hand-operated or power equipment can be used, depending on the extent of the investigation.

An important safety factor to consider in subsurface sampling is the avoidance of buried containers, pockets of highly concentrated material, and buried utility lines. A thorough background information search should be completed before obtaining subsurface samples. Before obtaining subsurface samples by hand, at a minimum, a metal detector survey should be performed. Metal detector surveys are almost usually conducted during Brownfield investigations to determine the presence of buried materials. The presence of buried tanks and materials is important in providing information when collecting deep subsurface samples with power equipment as well as in determining the redevelopment potential of property. However, when collecting deeper subsurface samples with power equipment, the local utilities should be contacted to locate underground utility lines. If funds are available, a survey using ground-penetrating radar is suggested before boring with power equipment. Most Brownfield investigations require the use of power equipment such as the Geoprobe and a backhoe to collect deep subsurface samples to assist in describing the nature of contamination at depth beneath the site and above the water table.

Locations for subsurface soil samples can be chosen on the basis of such background information as areas of past waste storage, the waste handling practices which may have given rise to contaminated soil, and geological survey information. Visual inspection of the study area may also help. If a large study area is involved or information about the entire area is needed as with Brownfield investigations, a random sampling approach similar to the types outlined above may be also be employed. any available hydrological data on seasonal water table levels and regional groundwater flow patterns should also be obtained.



#### **4.8.1.2 SAMPLING PROCEDURES**

A wide variety of information is available on sample collection. The IEPA Bureau of Land has reviewed and compiled this information into a step by step manual on how to collect samples. Refer to Appendix C, the IEPA Bureau of Land Sampling Procedures Guidance Manual for the specific procedure to collect soil and subsurface samples. It should be noted that in some instances, primarily during Brownfield investigations, a backhoe is used to open the hole and the sample is then collected following the procedure for collecting a sample with a hand auger. Subsurface samples may also be collected with the use of the Geoprobe (Refer to Section 4.9).

##### **Disposable En Core Sampler Sampling Procedures**

**Note:**

1. En Core Sampler is a single use device. It cannot be cleaned and/or reused.
2. En Core Sampler is designed to store soil. Do not use En Core Sampler to store solvent or free product.
3. En Core Sampler must be used with En Core T-Handle and/or En Core Extrusion Tool exclusively.

##### **Using the En Core T-Handle**

1. Before taking the sample hold the coring body and plunger rod down until a small o-ring rests against the tabs. This will ensure that the plunger moves freely.
2. Depress the locking lever on the In Core T-Handle. Place coring body, plunger end first, into the open end of the T-Handle, aligning the slots on the coring body with the two locking pins in the T-Handle, twist the coring body clockwise. The lock pins will be completely in the coring body slots. Check to ensure sampler is locked in and the sampler is ready for use.

##### **Collecting the Sample**

3. Turn the T-Handle with T-up and coring body down. This positions plunger bottom flush with bottom of the coring body. Ensure that the plunger body is in position. Using the T-Handle, push the sampler in soil until the coring body is full. When full a small o-ring will be centered in the T-Handle viewing hole. Wipe excess soil from the coring body exterior.
4. Cap the coring body while it is still on the T-Handle. Push the cap over the flat area of the ridge. Push and twist the cap to lock both arms in place. Cap must be seated properly

to seal the sampler. On incorrectly capped samplers, the caps will appear to be crooked and locking arms not fully secured to ridge.

## **Preparing Sampler For Shipment**

5. Remove the capped Sampler by depressing the locking lever on the T-Handle while twisting and pulling the sampler from the T-Handle.
6. Lock plunger by rotating the extended plunger rod fully counter-clockwise until wings rest firmly against tabs.
7. Attach applicable CLP tag directly to the Sampler.
8. Return full En Core Sampler to zipper bag and seal bag.
9. Attach CLP label directly to the zipper bag, place on ice and ship the Sampler the same day of collection

## **4.8.2 SEDIMENT SAMPLES**

### **4.8.2.1 SAMPLING LOCATIONS**

Sediment samples are valuable for locating pollutants of low water solubility and high soil binding affinity where surface waters might show trace quantities of contaminants, thus leading investigators to believe that an off-site contaminant migration problem is minor, the analysis of sediments might show otherwise. The sample that is most down gradient is to be sampled first. Heavy metals and high molecular weight halogenated hydrocarbons are examples of contaminant groups which might be found in greater concentrations in sediments.

Sediment sample locations are dependent upon the type of investigation. Sediment sampling locations for traditional CERCLA investigations are generally selected on the basis of the probability they will show contaminants migrating from a site. Therefore, for HRS scoring purposes samples should be taken from areas which are most likely to show contamination. Most these samples are grab samples (Refer to Section 6.4). Sediment samples are collected during Brownfield investigations if a water body is located on-site or if an impoundment or a lagoon is present on-site. If a surface water body, impoundment, or lagoon is located on-site, appropriate sampling locations are also selected on the most

probable location of impact. As was stated previously, Brownfield investigations are limited to on-site sampling. (It is important to note that the sediments obtained from surface impoundments, such as lagoons, which are suspected to be highly concentrated are to be handled and treated as hazardous samples).

The number of sampling locations is dependent on a variety of factors, including the size of a site, the availability of analytical support, and the objectives of the investigation. A recommended absolute minimum would be two locations, including one background location. Ideally, additional locations should be sampled, with some locations selected for taking a duplicate sample, which improves the quality control of the analytical data.

A background sediment sample should be obtained from sediments upstream from the suspected point source for running water and from sediments away from the suspected point source for standing surface water. In cases of high contamination of small bodies of standing water, it may be impossible to find a background sample. The analysis of background sediments attempts to establish the contribution of the source to pollution levels in the area. This is especially important if contamination with heavy metals is suspected because they occur naturally.

#### **4.8.2.2 SAMPLING PROCEDURES**

A wide variety of information is available on sample collection. The IEPA Bureau of Land has reviewed and compiled this information into a step by step manual on how to collect samples. Refer to Appendix C, the IEPA Bureau of Land Sampling Procedures Guidance Manual, for the specific procedure to collect sediment samples. Specific procedures for collecting samples from impoundments or lagoons is also contained in Appendix C.

### **4.9 SAMPLING WITH THE GEOPROBE**

#### **4.9.1 METHOD SUMMARY**

The Geoprobe<sup>TM</sup> sampling device is used to collect soil, soil-gas and groundwater samples at specific depths below ground surface (BGS). The Geoprobe<sup>TM</sup> is hydraulically powered and is mounted in a customized four-wheel drive vehicle. The base of the sampling device is positioned on the ground over the sampling location and the vehicle is hydraulically raised on the base. As the weight of the vehicle is transferred to the probe, the probe is

pushed into the ground. A built-in hammer mechanism allows the probe to be driven through dense materials. Maximum depth penetration under favorable circumstances is about 50 feet.

Soil samples are collected with a specially-designed sample tube. The sample tube is pushed and/or vibrated to a specified depth (approximately one foot above the intended sample interval). The interior plug of the sample tube is removed by inserting small-diameter threaded rods. The sample tube is then driven an additional foot to collect the samples. The probe sections and sample tube are then withdrawn and the sample is extruded from the tube into sample jars.

Soil gas can be collected in two ways. One method involves withdrawing a sample directly from the probe rods, after evacuating a sufficient volume of air from the probe rods. The other method involves collecting a sample through tubing attached by an adaptor to the bottom probe section. Correctly used, the latter method provides more reliable results.

Slotted lengths of probe can be used to collect groundwater samples if the probe rods can be driven to the water table. Groundwater samples are collected using either a peristaltic pump or a small bailer.

#### **4.9.2 INTERFERENCES AND POTENTIAL PROBLEMS**

A preliminary site survey should identify areas to be avoided with the truck. All underground utilities should be located and avoided during sampling. Begin sampling activities with an adequate fuel supply.

Decontamination of sampling tubes, probe rods, adaptors, non-expendable points and other equipment that contacts the soil is necessary to prevent cross-contamination of samples. Please refer to Section 4.13 for details concerning decontamination procedures. During sampling, the bottom portion and outside of the sampling tubes can be contaminated with soil from other depth intervals. Care must be taken to prevent soil which does not represent the sampled interval from being incorporated into the sample. Excess soil should be carefully wiped from the outside surface of the sampling tube and the bottom 3 inches of the sample should be discarded before extruding the sample into a sample jar.

Obtaining sufficient volume of soil for multiple analyses from one sample location may present a problem. The Geoprobe<sup>TM</sup> soil sampling system recovers a limited volume of

soil and it is not possible to reenter the same hole and collect additional soil. When multiple analyses are to be performed on soil samples collected with the Geoprobe™, it is important that the relative importance of the analyses be identified. Identifying the order of importance will ensure that the limited sample volume will be used for the most crucial analyses.

#### 4.9.3 **EQUIPMENT/APPARATUS**

Sampling with the Geoprobe™ involves use of the equipment listed below. Some of the equipment is used for all sample types, others are specific to soil (S), soil gas (SG), or groundwater (GW) as noted.

- Geoprobe™ sampling device
- Threaded probe rods (36", 24", and 12" lengths)
- Drive Caps
- Pull Caps
- Rod Extractor
- Expendable Point Holders
- Expendable Drive Points
- Solid Drive Points
- Extension Rods
- Extension Rod Couplers
- Extension Rod Handle
- Hammer Anvil
- Hammer Latch
- Hammer Latch Tool
- Drill Steels
- Carbide-Tipped Drill Bit
- Mill-Slotted Well Point (GW)
- Threaded Drive Point (GW)
- Well Mini-Bailer (GW)
- Tubing Bottom Check Valve (GW)

- 3/8" O.D. Low Density Polyethylene Tubing (GW, SG)
- Gas Sampling Adaptor and Cap (SG)
- Teflon Tape
- Neoprene "O" - Rings (SG)
- Vacuum System (mounted in vehicle) (SG)
- Piston Tip (S)
- Piston Rod (S)
- Piston Stop (S)
- Sample Tube (11.5" in length) (S)
- Vinyl Ends Caps (S)
- Sample Extruder (S)
- Extruder Pistons (Wooden Dowels) (S)
- Wire Brush
- Brush Adapters
- Cleaning Brush (Bottle)

#### **4.9.4      HEALTH AND SAFETY**

The following is a list of health and safety precautions which specifically apply to Geoprobe™ operation.

1. Always put vehicle in "neutral" and set the emergency brake before engaging remote ignition.
2. If vehicle is parked on a loose or soft surface, do not fully raise rear of vehicle with probe foot, as vehicle may fall or move.
3. Always extend the probe unit out from the vehicle and deploy the foot to clear vehicle roof line before folding the probe unit out.
4. Operators should wear OSHA approved steel-toed shoes and keep feet clear of probe foot.

5. Operator should wear ANSI approved hard hats.
6. Only one person shall be responsible for operating the hydraulic system. In most situations, an assistant is necessary to complete assembly and disassembly of probe rods and accessories.
7. Never place hands on top of a rod while it is under the machine.
8. Turn off the hydraulic system while changing rods, inserting the hammer anvil, or attaching accessories.
9. Operator must stand on the control side of the probe machine, clear of the probe foot and mast, while operating controls.
10. Wear safety glasses at all times during the operation of this machine.
11. Never continue to exert downward pressure on the probe rods when the probe foot has risen six inches off the ground.
12. Never exert enough downward pressure on a probe rod so as to lift the rear tires of the vehicle off the ground.
13. Always remove the hammer anvil or other tool from the machine before folding the machine to the horizontal position.
14. The vehicle catalytic converter is hot and may present a fire hazard when operating over dry grass or combustibles.
15. Geoprobe<sup>TM</sup> operators must wear ear protection. OSHA approved ear protection for sound levels exceeding 85 dba is recommended.
16. Locations of buried or underground utilities and services must be known before starting to drill or probe.

17. Shut down the hydraulic system and stop the vehicle engine before attempting to clean or service the equipment.
18. Exercise extreme caution when using extruder pistons (wooden dowels) to extrude soil from sample tubes. Soil in the sample tube may be compacted to the point that the extruder piston will break or shatter before it will push the sample out.
19. A dry chemical fire extinguisher (Type ABC) should be kept with the vehicle at all times.

#### 4.9.5 **PROCEDURES**

Portions of the following sections have been condensed from the Model 5400 Geoprobe™ Operations Manual(1). Refer to this manual for more detailed information concerning equipment specifications, general maintenance, tools, throttle control, clutch pump, GSK-58 Hammer, and trouble-shooting. A copy of this manual will be maintained with the Geoprobe™.

##### **PREPARATION**

1. Determine extent of the sampling effort, sample matrices to be collected, and types and amounts of equipment and supplies required to complete the sampling effort.
2. Obtain and organize necessary sampling and monitoring equipment.
3. Decontaminate or pre-clean equipment, and ensure that it is in working order.
4. Perform a general site survey prior to site entry in accordance with the site-specific Health and Safety Plan.
5. Use stakes or flagging to identify and mark all sampling locations. All



sample locations should be cleared for utilities prior to sampling.

### SETUP OF GEOPROBE™

1. Back carrier vehicle to probing location.
2. Shift the vehicle to park and shut off ignition.
3. Set parking brake.
4. Attach exhaust hoses so exhaust blows downwind of the sampling location (this is particularly important during soil gas sampling).
5. Start engine using the remote ignition at the Geoprobe™ operator position.
6. Activate hydraulic system by turning on the Electrical Control Switch located on the Geoprobe™ electrical control panel. When positioning the probe, always use the SLOW speed. The SLOW speed switch is located on the hydraulic control panel.

**Important: Check for clearance on vehicle roof before folding Geoprobe™ out of the carrier vehicle.**

7. Laterally extend the Geoprobe™ from the vehicle as far as possible by pulling the EXTEND control lever toward the back of the vehicle while the Geoprobe™ is horizontal.
8. Using the FOOT control, lower the Derrick Slide so it is below cylinder (A) before folding the Geoprobe™ out of the carrier vehicle. This will ensure clearance at the roof of the vehicle.
9. Use the FOLD, FOOT, and EXTEND controls to place Geoprobe™ to the exact probing location.

10. Using the FOLD control, adjust the long axis of the probe cylinder so that it is perpendicular (visually) to the ground surface.
11. Using the FOOT control, put the weight of the vehicle on the probe unit.  
Do not raise the rear of the vehicle more than six inches.

**Important: Keep rear vehicle wheels on the ground surface when transferring the weight of the vehicle to the probe unit. Otherwise, vehicle may shift when probing begins.**

12. When the probe axis is vertical and the weight of the vehicle is on the probe unit, probing is ready to begin.

#### DRILLING THROUGH SURFACE PAVEMENT OR CONCRETE

1. Position carrier vehicle to drilling location.
2. Fold unit out of carrier vehicle.
3. Deactivate hydraulics.
4. Insert carbide-tipped drill bit into hammer.
5. Activate HAMMER ROTATION control by turning knob counter-clockwise. This allows the drill bit to rotate when the HAMMER control is pressed.
6. Press down on HAMMER control to activate counterclockwise rotation.
7. Both the HAMMER control and the PROBE control must be used when drilling through the surface. Fully depress the HAMMER control, and incrementally lower the bit gradually into the pavement by periodically depressing the PROBE control.

8. When the surface has been penetrated, turn the HAMMER Control Valve knob clockwise to deactivate hammer rotation and remove the drill bit from the HAMMER.

**Important: Be sure to deactivate the rotary action before driving probe rods.**

#### PROBING

1. Position the carrier vehicle to the desired sampling location and set the vehicle parking brake.
2. Deploy Geoprobe™ Sampling Device.
3. Make sure the hydraulic system is turned off.
4. Thread the drive cap onto the male end of the probe rod.
5. Thread an expendable point holder onto the other end of the first probe rod.
6. Slip an expendable drive point into point holder.
7. Position the leading probe rod with expendable drive point in the center of the derrick foot and directly below the hammer anvil.

**Important: Positioning the first probe rod is critical in order to drive the probe rod vertically. Therefore, both the probe rod and the probe cylinder shaft must be in the vertical position.**

8. To begin probing, activate the hydraulics and push the PROBE Control downward. Many times the probe rods can be advanced using only the weight of the carrier vehicle. When this is the case, only the PROBE control is used.

**Important: When advancing rods, always keep the probe rods parallel to the probe cylinder shaft. This is done by making minor adjustments with the FOLD control. Failure to keep probe rods parallel to probe cylinder shaft may result in broken rods and increased difficulty in achieving desired sampling depth.**

#### PROBING -PERCUSSION HAMMER

The percussion hammer must be used in situations where the weight of the vehicle is not sufficient to advance the probe rods.

1. Make sure the Hammer Rotation Valve is closed.
2. Using the PROBE control to advance the rod, press down the HAMMER control to allow percussion to drive the rods.

**Important: Always keep static weight on the probe rod or the rod will vibrate and chatter while you are hammering, causing rod threads to fracture and break.**

3. Keep the hammer tight to the drive cap so the rod will not vibrate.
4. Periodically stop hammering and check if the probe rods can be advanced by pushing only.
5. Any time the downward progress of the probe rods is refused, the derrick foot may lift off of the ground surface. When this happens, reduce pressure on the PROBE control. Do not allow the foot to rise more than six inches off the ground or the vehicle's wheels may lift off the ground surface, causing the vehicle to shift.
6. As the derrick foot is raised off the ground surface, the probe cylinder may not be in a perpendicular position. If this happens, use the FOLD control to correct the probe cylinder position.

#### PROBING - ADDING RODS

1. Standard probe rods are four feet in length. If the desired depth is more than four feet, another rod must be threaded onto the rod that has been driven into the ground. In order to ensure a vacuum-tight seal (soil-gas sampling), two wraps of teflon tape around the thread is recommended.
2. Using the PROBE control, raise the probe cylinder as high as possible.

**Important: Always deactivate hydraulics when adding rods.**

3. Deactivate hydraulics.
4. Unthread the drive cap from the probe rod that is in the ground.
5. Wrap teflon tape around the threads.
6. Thread the drive cap onto the male end of the next probe rod to be used.
7. After threading the drive cap onto the rod to be added, thread the rod onto the probe rod that has been driven into the ground. Make sure threads have been teflon taped. Continue probing.
8. Continue these steps until the desired sampling depth has been reached.

PROBING/PULLING RODS

1. Once the probe rods have been driven to depth, they can also be pulled using the Geoprobe™ Machine.
2. Turn off the hydraulics.
3. Replace the drive cap from the last probe rod driven with a pull cap.
4. Lift up the hammer latch.

5. Activate the hydraulics.
6. Hold down on the PROBE control, and move the probe cylinder down until the latch can be closed over the pull cap.

**Important: If the latch will not close over the pull cap, adjust the derrick assembly by using the extend control. This will allow you to center the pull cap directly below the hammer latch.**

7. Retract the probe rods by pulling up on the PROBE control.

**Important: Do not raise the probe cylinder all the way when pulling probe rods or it will be impossible to detach a rod that has been pulled out. However, it is necessary to raise the probe cylinder far enough to allow the next probe section to be pulled.**

8. After retracting the first probe rod, lower the probe cylinder only slightly to ease the pressure off of the hammer latch.
9. If necessary, attach a clamping device to the base of the rods where it meets the ground to prevent rods from falling back into the hole.
10. Raise the hammer latch.
11. Hold the PROBE control up and raise the probe cylinder as high as possible.
12. Unthread the pull cap from the retracted rod.
13. Unthread the retracted rod.
14. Thread the pull cap onto the next rod that is to be pulled.
15. Continue these steps until all the rods are retracted from the hole.

16. Decontaminate all portions of the equipment that have been in contact with the soil, soil gas and groundwater.

#### SOIL GAS SAMPLING WITHOUT INTERIOR TUBING

1. Follow the procedures previously outlined for Geoprobe operation.
2. Thread on pull cap to end of probe rod.
3. Retract rod approximately six inches. Retraction of the rod disengages expendable drive point and allows for soil vapor to enter rod.
4. Unthread pull cap and replace it with a gas sampling cap. Cap is furnished with barbed hose connector.

**Important: Shut engine off before taking sample (exhaust fumes can cause faulty sample data).**

5. Turn vacuum pump on and allow vacuum to build in tank.
6. Open line control valve. For each rod used, purge 300 liters of volume.  
Example: Three rods used = 900 liters = .900 on gauge.
7. After achieving sufficient purge volume, close valve and allow sample line pressure gauge to return to zero. This returns sample train to atmospheric pressure.
8. The vapor sample can now be taken.
  1. Pinch hose near gas sampling cap to prevent any outside vapors from entering the rods.
  2. Insert syringe needle into center of barbed hose connector and

withdraw vapor sample.

9. To maintain suction at the sampling location, periodically drain the vacuum tank.
10. To remove rods, follow procedures as previously outlined.

### CALCULATIONS

Calculating Vapor Purge Volume for Soil-Gas Sampling without Interior Tubing

$$\begin{array}{lcl} \text{Volume of Air to be Purged (Liters)} & = & 300 \times \text{Number of Rods in the Ground} \\ \text{Volume in Liters/1000} & = & \text{Reading on Vacuum Pump} \\ & & \text{Instrument Gauge} \end{array}$$

### SOIL GAS SAMPLING WITH POST-RUN TUBING (PRT)

1. Follow procedures outlined in Sections 7.1 through 7.6.
2. Retract rod approximately six inches. Retraction of rod disengages expendable drive point and allows for soil vapor to enter rod.
3. Remove pull cap from the end of the probe rod.
4. Position the Geoprobe<sup>TM</sup> to allow room to work.
5. Secure PRT Tubing Adapter with "O" - Ring to selected tubing.
6. Insert the adapter end of the tubing down the inside diameter of the probe rods.
7. Feed the tubing down the hole until it hits bottom on the expendable point holder. Cut the tubing approximately two feet from the top probe rod.



8. Grasp excess tubing and apply some downward pressure while turning it in a counter-clockwise motion to engage the adapter threads with the expendable point holder.
9. Pull up lightly on the tubing to test engagement of threads.
10. Connect the outer end of the tubing to silicon tubing and vacuum hose (or other sampling apparatus).
11. Follow the appropriate sampling procedure to collect a soil-gas sample.
12. After collecting a sample, disconnect the tubing from the vacuum hose or sampling system.
13. Pull up firmly on the tubing until it releases from the adapter at the bottom of the hole.
14. Extract the probe rods from the ground and recover the expendable point holder with the attached adapter.
15. Inspect the "O"-ring at the base of the adapter to verify that proper sealing was achieved during sampling. The "O"-ring should be compressed.

**Note: If the "O"-ring is not compressed, vapors from within the probe sections may have been collected rather than vapors from the intended sample interval.**

#### SOIL SAMPLING

1. Follow the procedures previously outlined for Geoprobe operation.
2. Assemble soil-sampling tube.
  1. Thread piston rod into piston tip.

2. Insert piston tip into sample tube, seating piston tip into cutting edge of sample tube.
3. Thread drive head into threaded end of sample tube.
4. Thread piston stop pin into drive head. Stop pin should be tightened with wrench so that it exerts pressure against the piston rod.
3. Attach assembled sampler onto leading probe rod.
4. Drive the sampler with the attached probe rods to the top of the interval to be sampled.
5. Move probe unit back from the top of the probe rods to allow work room.
6. Remove drive cap and lower extension rods into inside diameter of probe rods using couplers to join rods together.
7. Attach extension rod handle to top extension rod.
8. Rotate extension rod handle clockwise until the leading extension rod is threaded into the piston stop downhole.
9. Continue to rotate extension rod handle clockwise until reverse-threaded stop-pin has disengaged from the drive head.
10. Remove extension rods and attached stop-pin from the probe rods.
11. Replace drive cap onto top probe rod.
12. Mark the top probe rod with a marker or tape at the appropriate distance above the ground surface (dependent on sample tube length).
13. Drive probe rods and sampler the designated distance. Be careful not to overdrive the sampler which could compact the soil sample in the tube, making it difficult to extrude.

**Important: Documentation of sample location should include both surface and subsurface identifiers. Example: Correct Method - Sample Location S-6, 12.0' - 13.0'. Incorrect Method - Sample Location S-6, 12.0'.**

14. Retract probe rods from the hole and recover the sample tube. Inspect the sample tube to confirm that a sample was recovered.
15. Disassemble sampler. Remove all parts.
16. Position extruder rack on the foot of the Geoprobe<sup>TM</sup> derrick.
17. Insert sample tube into extruder rack with the cutting end up.
18. Position the extruder piston (wood dowel) and push sample out of the tube using the PROBE control on the Geoprobe<sup>TM</sup>. Collect the sample as it is extruded in an appropriate sample container.

**Caution: use care when performing this task. Apply downward pressure gradually. Use of excessive force could result in injury to operator or damage to tools. Make sure proper diameter extruder piston is used.**

19. To remove rods, follow procedures previously outlined for Geoprobe use.

#### GROUNDWATER SAMPLING

1. Follow the instructions for probing found in Section 4.9.5 with the following exception: the Mill-Slotted Well Rod with attached threaded drive point should be the first section probed into the ground. Multiple sections of mill-slotted well rods can be used to provide a greater vertical section into which groundwater can flow.
2. Probe to a depth at which groundwater is expected.

3. Remove Drive Cap and insert an electric water-level indicator to determine if water has entered the slotted sections of probe rod.
4. If water is not detected in the probe rods, replace the drive cap and continue probing. Stop after each additional probe length and determine if groundwater has entered the slotted rods.
5. After the probe rods have been driven into the saturated zone, sufficient time should be allowed for the water level in the probe rods to stabilize.

**Note: It will be difficult if not impossible to collect a groundwater sample in aquifer material small enough to pass through the slots (<0.02 inch diameter).**

6. Groundwater samples will be collected with a low-flow peristaltic pump for all samples taken from the ground surface to a depth of twenty-eight feet. A twenty-millimeter Mini-Baler will be utilized for all groundwater samples collected below the depth of twenty-eight feet.

When the low-flow peristaltic pump is used in conjunction with the Geoprobe sampling device, the methods of determining groundwater stabilization include: 1) groundwater clarity 2) pH/conductivity/water temperature 3) pH test strips 4) draw-down of the well. The amount of groundwater purged from the Geoprobe sampling device will be determined by one of the previously mentioned stabilization criteria. The sampler will not collect the groundwater sample until groundwater conditions have stabilized within the sampling device.

**Sample fractions will be collected in the following order: volatile organics, semi-volatiles, and inorganics. Peristaltic pump rates are normally determined by groundwater recharge to the geoprobe sampling device and the fraction being sampled. Volatiles will be collected using the lowest possible flow rate of the peristaltic pump while the remaining fractions will be collected using the medium flow rate.**

**Important: Documentation of sample location should include both surface and subsurface identifiers. Example: Sample Location GW-6, 17'-21' bgs, water level in probe rods is 17 feet bgs, and the leading section of probe rod is**

**21 feet bgs. The water sample is from this zone, not from 17 feet bgs or 21 feet bgs.**

7. Remove rods following the procedures previously outlined for the Geoprobe

#### **4.9.6 SAMPLING LOCATIONS**

Sample locations are generally selected on the basis of the probability they will show contaminants or contaminants migrating from a site. For both traditional CERCLA investigations and Brownfield investigations, soil samples are generally located in areas of suspected contamination. However, during Brownfield investigations, soil samples may be collected from areas to ensure that the entire area is covered or as part of a grid sampling approach. For both investigations, groundwater samples are collected in areas of suspected contamination or from a location down gradient of these areas to determine if contamination is present and if it is migrating. Samples collected with the Geoprobe are grab samples (Refer to Section 4.4). Again, it is important that field personnel determine whether samples require handling as hazardous (concentrated) or environmental samples.

As in any sampling program, it is advisable to obtain an off-site, theoretically uncontaminated samples to establish background levels of analyzed chemicals.

#### **4.9.7 SAMPLING PROCEDURES**

A wide variety of information is available on sample collection. The IEPA Bureau of Land has reviewed and compiled this information into a step by step manual on how to collect samples. Refer to Appendix C, the IEPA Bureau of Land Sampling Procedures Guidance Manual, for the specific procedure to collect soil and groundwater samples using the Geoprobe.

The above sections contain specific sampling procedures for collecting groundwater, surface water, sediments, and soil samples. In general, most of the samples collected for traditional CERCLA investigations as well as Brownfield investigations will be from the media described in this section. However, there may be instances in which samples may

need to be collected from a drum, tank, container, etc. In these instances refer to the Bureau of Land Sampling Procedures Guidance Manual which is contained in Appendix C.

#### **4.10 FIELD MEASUREMENTS AND OBSERVATIONS**

While sampling, several quick field measurements and observations should be made and entered into a log book to help in interpreting the analytical data. The following are suggested field measurements and observations which should be noted in the field logbook:

- pertinent weather factors such as temperature, wind velocity and precipitation
- a sketch of the area indicating sample locations and depths, and site conditions.
- screening information such as TVA readings and Immunoassay results
- specific measurements of the sample location from permanent objects
- sample characteristics such as odor, color, composition, and turbidity.
- sample depth
- date and time of sample collection
- evidence of dead or stressed vegetation or animals
- stream characteristics such as stagnation or mixing which might affect the distribution or volatilization of contaminants in the water
- dissolved oxygen content of water sampled
- depth of stream or pond average (This may be limited to estimates, especially if access

is restricted to the shoreline. If using a sounding device, such as a graduated pole, perform this after samples have been obtained).

- flow rate of stream Estimate cross-sectional area from depth and width of stream. The cross-sectional area may be estimated by assuming that it is a triangle and using the formula  $A = (\frac{1}{2}) BC$ , where:  
A = cross-sectional area  
B = width of stream  
C = depth of stream at deepest point  
Multiply this area by velocity For a rough approximation of flow rate.
- water temperature, pH, and conductivity at point and time of sampling
- total depth well, diameter of well, depth to water, amount purged, and well integrity
- photo location and direction

#### **4.11 CONTAINERS, CLEANING OF CONTAINERS, AND SAMPLE PRESERVATION**

Table 6-1 specifies the recommended type and size of containers, number of containers, and sample preservation and holding times for site assessments. The container specifications listed are taken from "Specifications and Guidance for Contaminant-Free Sample Containers" EPA540/R-93/051, December 1992. The sample bottles the Division of Laboratories provides for use in the Site Assessment Program meet the specifications in EPA540/R-93/051.

Table 4-2 specifies the sample containers and holding times for samples collected for the Site Assessment Program.

#### **4.12 SAMPLE PACKAGING AND SHIPPING**

All state and Federal regulations regarding environmental sample packaging and shipping should be followed. Samples should be shipped according to the U.S. Department of Transportation (DOT) regulations. Sample ID and numbering will be according to procedures outlined in

## Appendix H.

Samples to be packaged and shipped must follow these requirements:

- check all lids to make sure they are tight and will not leak
- fill out label with a water-proof marker and place on each sample container; a clear piece of tape may be placed over the label to ensure it will remain on the jar (Refer to Section 5.2)
- fill out a sample tag with a water-proof marker for each sample container and tie or attach to the sample containers (Refer to Section 5.2 ) (IEPA laboratories and Brownfield Assessments going to CRL or CLP do not require tags for sample containers)
- enclose the sample container in a clear plastic bag making sure the sample tag and label are visible (IEPA laboratories do not require that the samples be placed in plastic bags)
- any samples suspected to be hazardous or of medium/high concentration must be enclosed in a metal paint can with a clipped or sealable lid (paint cans) with absorbent material around the sample container in the can
- pack the samples in ice (a bag of ice that is double bagged in garbage bags may be placed on top of the samples especially in warm weather) in a clean waterproof hard plastic ice cooler
- fill the remainder of the cooler with an absorbent packing material like Styrofoam or bubble wrap.
- place the top copy of the chain-of-custody forms in a plastic bag for CRL labs and the bottom two copies for CLP labs. The IEPA labs get the top copy also. Securely fasten forms to the lid of each cooler (IEPA laboratories have different chain-of-custody forms).
- place the chain-of-custody seals on the outside of the coolers across the top and sides so that it cannot be opened without breaking the seal



- fill out an air bill and ship samples overnight through a commercial carrier (Federal Express). For CRL and CLP, add a 3rd party airbill for return of the coolers.
- Please note: Encore sampling tubes should be shipped daily

#### **4.13 SAMPLING EQUIPMENT DECONTAMINATION**

This section provides a description of the methods used for preventing, minimizing, or limiting cross-contamination of samples due to inappropriate or inadequate equipment decontamination and to provide general guidelines for developing decontamination procedures for sampling equipment to be used during investigations for National Priorities List (NPL) sites.

These are standard (i.e. typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitation, or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

##### **4.13.1 METHOD SUMMARY**

Removing or neutralizing contaminants from equipment minimizes the likelihood of sample cross contamination, reduces or eliminates transfer of contaminants to clean areas, and prevents the mixing of incompatible substances.

Gross contamination can be removed by physical decontamination procedures. These abrasive and non-abrasive methods include the use of brushes, and high and low pressure water cleaning.

The first step, a soap and water wash, removes all visible particulate matter and residual oils and grease. This may be preceded by a steam or high pressure water wash to facilitate residuals removal. The second step involves a tap water rinse and a distilled/deionized water rinse to remove the detergent. A final distilled/deionized water rinse is performed. This rinse removes any residual traces of the solvent.

The decontamination procedure involves the following steps:

1. Physical removal
2. Non-phosphate detergent wash
3. Tap water rinse
4. Distilled/deionized water rinse
5. Air dry

Modifications to the standard procedure should be documented in the site specific work plan or subsequent report.

#### **4.13.2 INTERFERENCES AND POTENTIAL PROBLEMS**

- The use of distilled/deionized water commonly available from commercial vendors may be acceptable for decontamination of sampling equipment provided that it has been verified by laboratory analysis to be analyte free (specifically for the contaminants of concern).
- The use of an untreated potable water supply is not an acceptable substitute for tap water. Tap water may be used from any municipal or industrial water treatment system.

#### **4.13.3 EQUIPMENT/APPARATUS**

Decontamination equipment, materials, and supplies are generally selected based on availability. Other considerations include the ease of decontaminating or disposing of the equipment. Most equipment and supplies can be easily procured. For example, soft-bristle scrub brushes or long-handled bottle brushes can be used to remove contaminants. Large galvanized wash tubs, stock tanks, or buckets can hold wash and rinse solutions. Children's wading pools can also be used. Large plastic garbage cans or other similar containers lined with plastic bags can help segregate contaminated equipment. Contaminated liquid can be stored temporarily in metal or plastic cans or drums.

The following standard materials and equipment are recommended for decontamination activities:

**4.13.3.1      Decontamination Solutions**

Non-phosphate detergent  
Tap water  
Distilled or deionized water

**4.13.3.2      Decontamination Tools/Supplies**

Long and short handled brushes  
Bottle brushes  
Drop cloth/plastic sheeting  
Paper towels  
Plastic or galvanized tubs or buckets  
Pressurized sprayers (H<sub>2</sub>O)

**4.13.3.3      Health and Safety Equipment**

Appropriate personal protective equipment (i.e., safety glasses or splash shield, appropriate gloves, aprons or coveralls, respirator, emergency eye wash)

**4.13.3.4      Waste Disposal**

Trash bags  
Trash containers  
55-gallon drums  
Metal/plastic buckets/containers for storage and disposal of

## decontamination solutions

### 4.13.4 **PROCEDURES**

As part of the health and safety plan, a decontamination plan should be developed and reviewed. The plan should contain information such as the decontamination equipment needed and appropriate decontamination methods.

Procedures can also be established to minimize the potential for contamination. This may include: (1) work practices that minimize contact with potential contaminants; (2) using remote sampling techniques; (2) avoiding laying down equipment in areas of obvious contamination; and (3) use of disposable sampling equipment.

### 4.13.5 **DECONTAMINATION METHODS**

All samples and equipment leaving the contaminated area of a site must be decontaminated to remove any contamination that may have adhered to equipment. Decontamination methods will remove contaminants by flushing or other physical action. Physical decontamination techniques can be grouped into two categories: abrasive methods and non-abrasive methods, as follows:

#### Abrasive Cleaning Methods

Abrasive cleaning methods work by rubbing and wearing away the top layer of the surface containing the contaminant. The mechanical abrasive cleaning method is the most commonly used at hazardous waste sites.

Mechanical methods of decontamination include using metal or nylon brushes. The amount and type of contaminants removed will vary with the hardness of bristles, length of time brushed, degree of brush contact, degree of contamination, nature of the surface being cleaned, and degree of contaminant adherence to the surface.

### Non-Abrasive Cleaning Methods

Non-abrasive cleaning methods work by forcing the contaminant off a surface with pressure. In general, the equipment surface is not removed using non-abrasive methods.

#### Low-Pressure Water

This method consists of a container which is filled with water. The user pumps air out of the container to create a vacuum. A slender nozzle and hose allow the user to spray in hard-to-reach places.

#### High-Pressure Water

This method consists of a high-pressure pump, an operator controlled directional nozzle, and a high-pressure hose. Operating pressure usually ranges from 340 to 680 atmospheres (atm) and flow rates usually range from 20 to 140 liters per minute.

#### Rinsing

A final rinse with deionized water is performed

#### Damp Cloth Removal

In some instances, due to sensitive, non-waterproof equipment or due to the unlikelihood of equipment being contaminated, it is not necessary to conduct an extensive decontamination procedure. For example, air sampling pumps hooked on a fence, placed on a drum, or wrapped in plastic bags are not likely to become heavily contaminated. A damp cloth should be used to wipe off contaminants which may have adhered to equipment through airborne contaminants or from surfaces upon which the equipment was set.

### **4.13.6 Field Sampling Equipment Decontamination Procedures**

The decontamination area is setup so that the first station is used to clean the most contaminated item. It progresses to the last station where the least contaminated item is cleaned. Ideally, the contamination should decrease as the equipment progresses from one area to another.

A site is typically divided up into the following boundaries: Hot Zone or Exclusion Zone (EZ), the Contamination Reduction Zone (CRZ), and the Support or Safe Zone (SZ). The decontamination area should be setup in the CRZ. The CRZ controls access into and out of the exclusion zone and confines decontamination activities to a limited area. The size of the decontamination area depends on the number of stations in the decontamination process, overall dimensions of the work zones, and amount of space available at the site.

Anyone in the CRZ should be wearing the level of protection designated for the decontamination crew. Sampling and monitoring equipment and sampling supplies are all maintained outside of the CRZ. Personnel don their equipment away from the CRZ

#### **4.13.6.1 Decontamination Setup and Procedures**

Starting with the most contaminated station, the decontamination setup should be as follows:

##### **Step 1 Physical Removal With Brushes And A Wash Basin**

Prior to setting up Station 3, place plastic sheeting on the ground to cover areas under Station 3 through Station 10.

Fill a wash basin, a large bucket, or child's swimming pool with non-phosphate detergent and tap water. Several bottle and bristle brushes to physically remove contamination should be dedicated to this station. Approximately 10 - 50 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

##### **Step 2 Water Basin(Optional)**

Fill a wash basin, a large bucket, or child's swimming pool with tap water. Several bottle and bristle brushes should be dedicated to this station. Approximately 10 - 50 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

#### Step 3 Physical Removal With A High-Pressure Washer (Optional)

As indicated in 4.13.5, a high-pressure wash may be required for compounds which are difficult to remove by washing with brushes. The elevated temperature of the water from the high-pressure washers is excellent at removing greasy/oily compounds. High pressure washers require water and electricity.

A decontamination pad may be required for the high-pressure wash area. An example of a wash pad may consist of an approximately 1 1/2 foot-deep basin lined with plastic sheeting and sloped to a sump at one corner. A layer of sand can be placed over the plastic and the basin is filled with gravel or shell. The sump is also lined with visqueen and a barrel is placed in the hole to prevent collapse. A sump pump is used to remove the water from the sump for transfer into a drum.

Typically heavy machinery is decontaminated at the end of the day unless site sampling requires that the machinery be decontaminated frequently. A separate decontamination pad may be required for heavy equipment.

#### Step 4 Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to contain the water during the rinsing process. Approximately 10-20 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

#### Step 5 Clean Equipment Drop

Lay a clean piece of plastic sheeting over the bottom plastic layer. This will allow easy removal of the plastic in the event that it becomes dirty.

#### **4.13.7 POST DECONTAMINATION PROCEDURES**

1. Collect high-pressure pad and heavy equipment decontamination area liquid and waste and store in appropriate drum or container. A sump pump can aid in the collection process. Refer to the Department of Transportation (DOT) requirements for appropriate containers based on the contaminant of concern.
2. Collect high-pressure pad and heavy equipment decontamination area solid waste and store in appropriate drum or container. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.
3. Empty soap and water liquid wastes from basins and buckets and store in appropriate drum or container. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.
4. Using low-pressure sprayers, rinse basins, and brushes. Place liquid generated from this process into the wash water rinse container.
5. Place all solid waste materials generated from the decontamination area (i.e., gloves and plastic sheeting, etc.) in an approved DOT drum. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.
6. Write appropriate labels for waste and make arrangements for disposal. Consult DOT regulations for the appropriate label for each drum generated from the decontamination process.

#### **4.13.8 QUALITY ASSURANCE/QUALITY CONTROL**

A rinsate blank is one specific type of quality control sample associated with the field



decontamination process. This sample will provide information on the effectiveness of the decontamination process employed in the field. Rinsate blanks are samples obtained by running analyte free water over decontaminated sampling equipment to test for residual contamination. The blank water is collected in containers for handling, shipment, and analysis. These samples are treated identical to samples collected that day. A rinsate blank is used to assess cross contamination brought about by improper decontamination procedures. If sampling equipment requires the use of plastic tubing it should be disposed of as contaminated and replaced with clean tubing before additional sampling occurs.

#### **4.13.9 DATA VALIDATION**

Results of quality control samples will be evaluated for contamination. This information will be utilized to qualify the environmental sample results in accordance with the project's data quality objectives.

#### **4.13.10 HEALTH AND SAFETY**

When working with potentially hazardous materials, follow OSHA, U.S. EPA, corporate, and other applicable health and safety procedures.

Safety considerations should be addressed when using abrasive and non-abrasive decontamination equipment. Maximum air pressure produced by abrasive equipment could cause physical injury. Displaced material requires control mechanisms.

Material generated from decontamination activities requires proper handling, storage, and disposal. Personal Protective Equipment may be required for these activities.

#### **4.14 INVESTIGATION-DERIVED WASTES**

If investigation-derived wastes (IDW) are **RCRA nonhazardous soil or water**, they should be left on-site unless other circumstances require off-site disposal. The nature of the wastes should be assessed by applying best professional judgement, using readily available information about the site. This information may include manifests, storage records, preliminary assessments, and results of earlier studies that may have been conducted and are available to the Agency. Direct observation of the IDW for discoloration, odor, or other indicators of contamination should also be

considered.

If the IDW are nonhazardous, the Project Manager must determine procedures for handling IDW on-site and notify the site owner in the site access agreement form that IDW such as soil cuttings and water will be left on-site. The on-site handling options available to the Project Manager when IDW are RCRA nonhazardous are the following:

1. For soil cuttings:
  - a. Spread around the well
  - b. Put back into the boring
  - c. Dispose of at the site's TDU
2. For groundwater:
  - a. Pour onto ground next to the well to allow infiltration
  - b. Dispose of at the site's TDU
3. For decontaminated PPE
  - a. Double bag and deposit in the site or EPA dumpster, or in any municipal landfill
  - b. Dispose of at the site's TDU

If IDW are considered RCRA non-hazardous due to lack of information on the waste hazard, the inspection team should have an alternative plan for handling IDW if field conditions indicate that these wastes are hazardous. In such a case, the Project Manager should be prepared to make arrangements to obtain containers for collecting groundwater, decontamination waste, and/or soil cuttings.

If IDW consist of **RCRA hazardous soils that pose no immediate threat to human health and the environment**, the Project Manager should plan on leaving it on-site until it can be properly disposed of in accordance with 35 IAC Parts 722 and 809 for off-site removal.

IDW should be disposed off-site in the following situations:

1. They are RCRA hazardous water
2. They are RCRA hazardous soil that may pose a substantial risk if left at the site

3. They are RCRA hazardous PPE and DE
4. Leaving them on-site would create increased risk at the site.

The IEPA expects that complying with this guidance will limit on-site storage to, at most, the time required to complete any testing (usually less than 6 weeks) required by subcontractors in order to arrange for transportation. In most cases, this will not result in exceeding the regulatory 90 day storage time for quantities greater than 1,000 kg/month regardless of the quantity of IDW. In cases where the regulatory 90 day storage time for quantities greater than 1,000 kg/month is exceeded, the Project Manager must initiate a bidding process to remove IDW wastes off-site and a permit is not required.

#### **4.15 CALIBRATION OF SAMPLING EQUIPMENT**

This group of equipment provides a significant amount of actual field data and associated quality control problems. Included in this group are pH meters, water conductivity meters, thermometers, toxic vapor analyzer, combustible gas meters, geophysical equipment, and water level indicators (M scopes). Proper care and maintenance is essential. In addition, proper calibration and operational experience is required to assure valid data.

Each instrument in this group comes with an instruction manual detailing the procedures and theory of operation, calibration procedures, and frequency and maintenance requirements. Quality control measures For these instruments include performance of required maintenance, operational checks, and established calibration schedules. These items should be recorded in a logbook for each piece of equipment.

The major problems encountered with this equipment are:

- failure to calibrate equipment prior to use
- inexperience in operating the equipment
- inability to assure proper functioning of equipment
- improper cleaning and maintenance of the equipment

An obvious solution to these problems is to provide training to the individuals using the equipment. Since this is not always possible, another solution is to maintain a comprehensive manual containing the manufacturer's instruction manuals for all the equipment. Each team could then review the appropriate equipment instructions prior to use. This information is kept at the IEPA warehouse with the equipment. In some cases, access to the operations manual also allows inexperienced individuals to successfully operate the instruments. It is recommended that an experienced individual oversee the novice.

To ensure proper calibration, each instrument should be tagged with a label indicating when calibration is required. In the case of simple instruments such as pH, conductivity, and combustible gas meters, these would be calibrated before each use. Appropriate calibration standards should be stored with the instruments. In this way, the necessary calibration materials are taken to the field with the instruments. The calibration data, together with the field data are then recorded in the logbook.

To insure that instruments are operating properly, several solutions are available. These include:

- proper calibration as above
- having a supply of appropriate batteries For the units
- having properly charged batteries where replacement is impractical
- using a solvent-based marker to check organic vapor analyzers and combustible gas detectors
- breathing on an oxygen monitor to produce a meter response

Additionally, some instruments use Ni-Cad or Gel-Cell rechargeable batteries. The Ni-Cad units need to be cycled from fully charged to deep discharge monthly to insure stable charging characteristics and maximum battery life. The Gel-Cell batteries, however, should never be deep discharged as they will never hold a full charge again. this will significantly reduce field use and can lead to erratic data. Gel-Cells should be kept on charge when not in use.

#### REFERENCES - SECTION 4.0

Environmental Response Team, 1980. Field Monitoring and Analysis of Hazardous Materials. EPA Training Manual, Course #165.4, Cincinnati, Ohio.

Environmental Protection Agency, 1973. Handbook for Monitoring Industrial Wastewater. U.S. EPA Technology Transfer.

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Weber, C.I., 1973. Biological Field and Laboratory Methods for Measuring the Quality of Surface Waters and Effluents. U.S. EPA-670/4-73-001.

Model 5400 Geoprobe™ Operations Manual. Geoprobe™ Systems, Salina, Kansas. July 27, 1990.

Geoprobe™ Systems - 1995-96 Tools and Equipment Catalog.

Environmental Response Team, 1996, Model 5400 Geoprobe Operation, SOP #2050.

## 5.0 SAMPLE CUSTODY

### 5.1 INTRODUCTION

A sample is in someone's custody if it is in their physical possession, it is in their view after being in their physical possession, it is in their physical possession and secured so that it cannot be tampered, it is kept in a secured area restricted to authorized personnel only. There are two types of custody, field custody and laboratory custody.

### 5.2 FIELD CUSTODY

Samples should always be kept in possession in the field. This task is normally assigned to the field person responsible for the chain-of-custody procedures. The US EPA CLP laboratories, CRL, CLP and IL EPA laboratories are used for analyzing samples and have different chain of custody forms. Appendix G provides samples of the sample tags, labels and chain-of-custody forms that are used in the US EPA CLP. Appendix C provides samples of the chain-of-custody forms that are used for the IL EPA laboratories.

Following is a list of procedures to follow in order to provide appropriate chain-of-custody.

- complete label with a water-proof marker and place on each sample container; a clear piece of tape may be placed over the label to ensure it will remain on the jar (Refer to Appendix F, different labs have different labels ); proper labeling will prevent misidentification of samples. The Brownfield Redevelopment Assessments do not need the sample tag
- complete a sample tag with a water-proof marker for each sample container and tie or attach to the sample containers (Refer to Appendix E). IEPA laboratory samples and Brownfield Assessments going to CLP or CRL do not require tags for sample containers (Refer to Appendix C).
- enclose the sample container in a clear plastic bag making sure the sample tag and label are visible (IEPA laboratories do not require that the samples be placed in plastic bags)

- complete the chain-of-custody record for each sample (different labs require different forms)
- have the sampler sign, date, write the seal time, and write the seal numbers on the chain-of-custody record
- each time the samples are transferred from the custody of one person to another, the chain-of-custody record should reflect this action via a signature on the sheet
- complete two separate chain-of-custody records, if the sample is going to two different laboratories
- place the chain-of-custody seals on the outside of the coolers across the top and sides so that it cannot be opened without breaking the seal and ship according to the procedures outlined in Section 4.12

### **5.3 LABORATORY CUSTODY**

The laboratory responsibility for sample security and integrity begins with the delivery of the samples to the laboratory.

- **Sample collectors or messengers bring samples to the reception room.**
- **The messenger lines up samples on the receiving table with the appropriate sample report form filled out containing the necessary information to identify the sample.**
- **Laboratory personnel check coding on sample containers to ensure that samples are properly coordinated with the report forms.**



- **Laboratory numbers are assigned to the report form and these numbers are plainly marked on the appropriate sample containers.**
- **Collectors/messengers are asked to wait until numbering is completed as a further check on sample integrity.**
- **Laboratory personnel sign for each sample on the appropriate report form and at this time notes on the report any deviations from sample preservation procedures.**
- **Sample information is logged into a computer.**
- **Sample distribution in the laboratory is carried out by the receiving section to ensure that samples are sent to proper areas for analyses.**
- **All laboratories are locked at the end of the day.**
- **Samples are retained in the laboratory, if requested, until the final report is submitted or litigation has been completed.**
- **If required, facilities are available for securing samples under lock and key.**
- **"Raw" data books must include the method used to make the measurement, the date of the measurement, the analyst's signature, the observed value, all calculations and the result.**

- **If automated equipment is used with results printed out on digitizer tape, the digitizer tapes are to be numbered, filed and become a permanent raw data record. Cross-reference should be made between the tape numbering system, the sample number and the notebook system so the original tape can be retrieved as required. The analyst must sign and date these charts.**
- **If observations are recorded on a strip chart, calculations can be performed and the result can be written on the strip chart. Peaks for each sample number must be identified, using the sample number and/or standard concentration values. Strip charts are numbered and filed in a secure location as a permanent location record. The analyst must sign and date these charts.**
- **When containers, samples, or extracts are transferred from one laboratory to another, the appropriate chain-of-custody sign out/in protocol must be used. Samples or extracts should be shipped in sealed containers, where necessary, following the appropriate DOT regulations.**

#### **5.4 FINAL EVIDENCE FILE**

Once the data package equivalent to CLP requirements are prepared and sent to the IEPA, a copy of the same data package is retained at the laboratory. The IEPA QA officer and site assessment staff assess the data package and then the data is stored in the Division of Land Pollution file until further use. CRL maintains the original CLP and CRL data and the IEPA Site Assessment Unit maintains field notes.

#### **REFERENCES - SECTION 5.0**

Environmental Protection Agency, 1995. Sampler's Guide to the Contract Laboratory. OSWER Directive 9240.0-01D EPA/540 P-90 006.

Environmental Protection Agency, Office of Emergency and Remedial Response, January, 1991. User's Guide to the Contract Laboratory Program. (OSWER Directive 9240.0-01D).

## 6.0 CALIBRATION PROCEDURE AND FREQUENCY

### 6.1 Laboratory Instrument Calibration

The samples collected by the Site Assessment Program are analyzed by the USEPA CLP, by the IEPA Division of Laboratories, and by the USEPA Region 5 CRL. For the Program the IEPA utilizes the USEPA CLP SOWs for RAS equivalent analyses. ALL non-RAS sample analyses is obtained from the USEPA Region 5.

#### Calibration Procedures & Frequency for RAS and SAS analysis

The CLP calibration procedure and frequencies are specified in the CLP organic and inorganic SOWs.

#### SAS Calibration Procedures & Frequency

The SASs calibration procedures and frequency are specified in the SASs request.

#### CRL Calibration Procedures and Frequency

The CRL calibration procedures and frequency are specified in the CRL organic and inorganic SOPs.

### 6.2 Field Instrument Calibration

#### XRF Calibration Procedures & Frequency

The XRF calibration procedures and frequency are specified in the XRF SOP.

#### TVA Calibration Procedures & Frequency

The TVA calibration procedures and frequency are specified in ' ' ' SOP.

## 7.0 ANALYTICAL PROCEDURES

The samples collected by the Site Assessment Program are analyzed by the USEPA CLP, by the IEPA Division of Laboratories, and by the USEPA Region 5 CRL. For the Program the IEPA utilizes the USEPA CLP SOWs for RAS equivalent analyses. ALL non-RAS sample analyses is obtained from the USEPA Region 5 and/or IEPA. When the IEPA lab is used, a copy of their SOP's should be included in the sampling plan. CRL will follow their own internal SOP's which will contain the analytical procedures.

### Routine Analytical Services Laboratory Procedures (RAS)

All samples for CLP TCL VOAs and semivolatiles and CLP TAL inorganic (total metals and cyanide) will be analyzed according to analytical procedures set forth in the U.S. EPA CLP RAS SOW (OLM03.1) for organics analysis, and RAS SOW (ILM04.0) for inorganic analysis RAS SOW (OLC03.2). See Appendix E.

### Special Analytical Services Laboratory Procedures (SAS)

The analytical procedures to be used for performing the SAS analyses are described in the SAS requests obtained from Region 5. The SAS requests specified calibration procedures, frequency of calibration, and the internal quality control checks required for each analysis.

## 8.0 DATA REDUCTION VALIDATION and REPORTING

All samples collected for will be sent to the CLP Laboratory, the IEPA Laboratories, or CRL. Data reduction, evaluation, and reporting for samples analyzed by the CLP or the IEPA performed according to specifications outlined in the CLP RAS SOW (OLM03.1) or the most current for the organics and SOW (ILM04.0), OLC03.2 or the most current version for inorganics. Then, if the USEPA CLP is used data will be sent to the EPA, Region 5 for data validation, if the IEPA Laboratories are used data will be sent to the IEPA Division of laboratories/Quality Assurance Section for validation, if the CRL is used data reduction will be performed according to specification outlined in the CRL SOP by CRL.

Data resulting from SAS request will be reduced, evaluated and reported as described above unless special procedures are given in the actual SAS request.

### 8.1 Data Validation

Data validation procedures shall be performed for laboratory operations as described below:

#### 8.1.1 Procedures to Validate Laboratory Data

USEPA Contract Laboratory Program National Functional Guidelines for Organic and Inorganic Data Review, February 1994, procedures will be followed to validate USEPA CLP RAS analyses or IEPA generated CLP RAS equivalent analyses. Validation of CRL and SAS data will follow Region 5 and/or CRL validation SOPs. Most CLP data for Site Assessments and Redevelopment Assessments will be performed by CADRE. A full manual review can be requested and performed for certain sensitive sites (i.e. NPL listings).

### 8.2 Data Reporting

Data reporting procedures shall be carried out for laboratory operations as indicated below:

### 8.2.1 **Laboratory Data Reporting**

The task of reporting laboratory data (to the U.S. EPA) begins after the validation activity has been concluded. The IEPA Division of Laboratories Quality Assurance Section Manager oversees the final review of the report summaries and case narratives to determine whether the report meets program requirements. In addition to the record of chain-of-custody, the report format shall consist of the following:

1. Case Narrative:

- Date of issuance
- Laboratory analysis performed
- Any deviations from intended analytical strategy
- Laboratory batch number
- Numbers of samples and respective matrices
- Quality control procedures utilized and also references to the acceptance criteria
- Laboratory report contents
- Project name and number
- Condition of samples 'as-received'
- Discussion of whether or not sample holding times were met
- Discussion of technical problems or other observations which may have created analytical difficulties
- Discussion of any laboratory quality control checks which failed to meet project criteria
- Signature of the Laboratory QA Manager

2. Chemistry Data Package

- Case narrative for each analyzed batch of samples
- Summary page indicating dates of analyses for samples and

laboratory quality control checks

- Cross referencing of laboratory sample to project sample identification numbers
- Data qualifiers to be used should be adequately described
- Sample preparation and analyses for samples
- Sample results
- Raw data for sample results and laboratory quality control samples
- Results of (dated) initial and continuing calibration checks, and GC/MS tuning results
- Matrix spike and matrix spike duplicate recoveries, laboratory control samples, method blank results, calibration check compounds, and system performance check compound results
- Labeled (and dated) chromatograms/spectra of sample results and laboratory quality control checks
- Results of tentatively identified compounds

## 9.0 INTERNAL QUALITY CONTROL CHECKS

### 9.1 **USEPA CLP RAS and IEPA CLP RAS Equivalent Internal Quality Control Checks**

Internal quality control procedures for RAS from the CLP are specified in the Statement of Works (SOWs) for organics and inorganics, or in the method description of SOPs. These specifications include the types of QC checks required (method blanks, reagent/preparation blanks, matrix spike and matrix spike duplicates, calibration standards, internal standards, surrogate standards, the frequency of each audit, the specific calibration check standards, laboratory duplicate/replicate analysis), compounds and concentrations to be used, and the quality control acceptance criteria for these audits.

### 9.2 **USEPA Region 5 CRL Internal Quality Control Checks**

Internal quality control checks will be followed according to CRL SOPs.

### 9.3 **SAS INTERNAL QUALITY CONTROL CHECKS**

Quality control checks for SAS are identified in the QC requirements Section of the SAS requests developed at the time of sampling



## 10.0 PERFORMANCE and SYSTEM AUDITS

Performance and system audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in the field sampling plan and QAPP. The audits of field and laboratory activities include two independent parts: internal and external audits.

### **10.1 Field Performance and System Audits**

#### **10.1.1 Internal Field Audits**

##### **10.1.1.1 Internal Field Audit Responsibilities**

Internal audits of field activities including sampling and field measurements will be conducted by the site project manager.

##### **10.1.1.2 Internal Field Audit Frequency**

These audits will verify that all established procedures are being followed. Internal field audits will be conducted at least once at the beginning of the site sample collection activities.

##### **10.1.1.3 Internal Field Audit Procedures**

The audits will include examination of field sampling records, field instrument operating records, sample collection, handling and packaging in compliance with the established procedures, maintenance of quality assurance procedures, chain-of-custody, etc. The audits will involve review of field measurement records, instrumentation calibration records, and sample documentation.

## **10.1.2 External Field Audits**

### **10.1.2.1 External Field Audit Responsibilities**

External field audits may be conducted by the U.S. EPA Region 5.

### **10.1.2.2 External Field Audit Frequency**

External field audits may be conducted any time during the field operations. These audits may or may not be announced and are at the discretion of the U.S. EPA Region 5.

### **10.1.2.3 Overview of the External Field Audit Process**

External field audits will be conducted according to the field activity information presented in the QAPP.

## **10.2 Laboratory Performance and Systems Audits**

### **10.2.1 Contract Laboratory Program Laboratories**

The Contract Laboratory Program (CLP) Routine Analytical Services laboratories are audited on a regular basis by US EPA. The US EPA EMSL-Las Vegas conducts the system audits of the CLP laboratories on an annual basis and conduct performance audits on a quarterly basis. The system audits, which will include examination of laboratory documentation on sample receiving, sample log-in, sample storage, chain of custody procedures, sample preparation and analysis, instrument operating records, etc. The performance audits will consist of sending performance evaluation (PE) samples to CLP laboratories for on-going assessment of laboratory precision and accuracy. The analytical results of the analysis of PE samples are evaluated by US EPA to ensure that the laboratory maintain a good performance.

### **10.2.1.1 Internal Laboratory Audits**

#### **10.2.1.1.1 Internal Laboratory Audit Responsibilities**

The internal laboratory audit will be conducted by the QA Officer.

#### **10.2.1.1.2 Internal Lab Audit Frequency**

The internal lab system audits will be done on an annual basis while the internal lab performance audits will be conducted on a quarterly basis.

#### **10.2.1.1.3 Internal Lab Audit Procedures**

The internal lab system audits will include an examination of lab documentation on sample receiving, sample log-in, sample storage, chain of custody procedures, sample preparation and analysis, instrument operating records, etc. The performance audits will involve preparing blind QC samples and submitting them along with project samples to the laboratory for analysis throughout the project. The QA Officer will evaluate the analytical results of these blind performance samples to ensure the laboratory maintains acceptable QC performance.

### **10.2.2 IL EPA Laboratory Program Laboratories**

#### **10.2.2.1 Internal IL EPA Laboratory Audits**

Internal system audits will consist of an annual assessment of the laboratories' quality assurance systems, good laboratory practices, and method performance to assure program requirements are followed. The internal system audit will be conducted by the QA officer within each of the State laboratories. If any negative findings are determined, they will be reported to the unit supervisor and/or Laboratory manager and the Division Quality Assurance Officer.

## 11.0 PREVENTATIVE MAINTENANCE PROCEDURES AND SCHEDULES

Maintenance of the equipment is an important part of every laboratory operation. In the Division of Laboratories, the responsibility of routine care lies with the analysts using the instruments. Every manufacturer furnishes an instrument maintenance manual. These are kept on file in each laboratory for frequent reference. Repairs which cannot be performed are contracted to the manufacturer's servicemen. The analytical balances are checked annually under service contracts. In addition, the organic laboratory has a full-time Laboratory Equipment Specialist who takes care of most of the problems.

Preventive maintenance procedures are described in detail in the Quality Assurance Manuals for each laboratory dated September, 1981. A summary of the procedures used in the Champaign and Springfield laboratories is shown in Tables 13-1 and 13-2.

Preventive maintenance procedures for field equipment are as follows:

- A. Temperature/pH/Specific Conductance meter maintenance includes routine cleaning, replacement of batteries as needed and electrode reconditioning as needed.
- B. Combustible Gas/O<sub>2</sub> Detector maintenance includes cleaning as needed and battery and sensor replacement as necessary.
- C. HN<sub>u</sub> - Photo-Ionization Detector maintenance includes cleaning as needed, lamps replaced as necessary and calibration with span gases provided by the manufacturer following lamp replacement.

## 12.0 SPECIFIC PROCEDURES USED to ASSESS DATA PRECISION, ACCURACY and COMPLETENESS

### 12.1 Accuracy Assessment

In order to assure the accuracy of the analytical procedures, an environmental sample will be randomly selected from each sample shipment received at the laboratory, and spiked with a known amount of the analyte or analytes to be evaluated. In general, a sample spike will be included in every set of 20 samples tested on each instrument. The spike sample will be then analyzed. The increase in concentration of the analyte observed in the spiked sample, due to the addition of a known quantity of the analyte, compared to the reported value of the same analyte in the unspiked sample determines the percent recovery. Daily control charts will be plotted for each commonly analyzed compound and kept on instrument-specific, matrix - specific, and analyte - specific bases. The percent recovery for a spiked sample is calculated according to the following formula:

$$\%R = \frac{\text{Amount in Spiked Sample} - \text{Amount in Sample}}{\text{Known Amount Added}} \times 100$$

### 12.2 Precision Assessment

Spiked samples are prepared by choosing a sample at random from each sample shipment received at the laboratory, dividing the sample into equal aliquots, and then spiking each of the aliquots with a known amount of analyte. The duplicate samples will be then included in the analytical sample set. The splitting of the sample allows the analyst to determine the precision of the preparation and analytical techniques associated with the duplicate sample. The relative percent difference (RPD) between the spike and duplicate spike will be calculated and plotted. The RPD is calculated according to the following formula:

$$RPD = \frac{\text{Amount in Spike 1} - \text{Amount in Spike 2}}{0.5(\text{Amount in Spike 1} + \text{Amount in Spike 2})} \times 100$$

### 12.3 Completeness Assessment

Completeness is the ratio of the number of valid sample results to the total number of samples analyzed with a specific matrix and/or analysis. Following completion of the analytical testing, the percent completeness will be calculated by the following equation:

$$\text{Completeness} = \frac{(\text{number of valid measurements})}{(\text{number of measurements planned})} \times 100$$

### 13.0 CORRECTIVE ACTION

For each analytical method employed in this program, the individual State laboratory will regularly track precision and accuracy by computing the RPD for duplicate sample analyses along with periodic determinations of spiked sample recovery. The mean recovery and the relative percent differences of the results will be computed. These data will be accumulated for each kind of sample matrix analyzed. These statistics will be updated as additional analyses are performed and more experience is gained. When either the precision from replicate analyses or relative percent difference and/or the accuracy from recovery data exceeds two times the goals (Section 3.0 of this manual), the procedure will be checked for calibration, quality of the standards and analytical techniques. When the precision or accuracy exceeds three times the goals (Section 5.0 of this manual), analysis will be stopped and corrective action will be taken.

Corrective actions could include, but not necessarily be limited to, recalibration of instruments using freshly prepared calibration standards; replacement of solvent lots or other reagents that give unacceptable blank values; additional training of laboratory personnel in correct implementation of sample preparation and analysis methods, and reassignment of personnel, if necessary, to improve the overlap between operator skills and method requirements. After the corrective actions have been taken and satisfactory quality control sample results are obtained, samples will be re-run.

## 14.0 QUALITY ASSURANCE REPORTS to MANAGEMENT

The Quality Assurance Officer within each State laboratory is responsible for day-to-day Quality Assurance. This officer is responsible for taking corrective action and, if necessary, providing a written report to the Laboratory Manager. The Quality Assurance Committee is the direct link between the laboratory sections and the quality assurance section. The committee is composed of a representative from each laboratory. The Quality Assurance committee reviews the Agency laboratories, and designs and implements quality assurance and control procedures. Implementation of quality assurance activities recommended by the committee is basically at the section level. The Quality Assurance section, which reports directly to the Manager of the Division of Laboratories, is responsible for overall Quality Assurance of all laboratories and improvement of QA actions. Specific QA reports are not required on a fixed timetable.

CLP and CRL will follow their SOWs and SOPs for corrective action. Field instrumentation quality assurance is followed per the instrument's SOP.



# **APPENDIX A**

## **TABLES**

TABLE 3-1  
OA OBJECTIVES FOR LABORATORY PARAMETERS (CLP)

Matrix Spike Recovery and Relative Percent Difference Limits (RPD)				
	%Recovery		%RPD	
	Water	Soil	Water	Soil
Metals and Cyanide	75-125	75-125	20	20
Volatile Organic Compounds				
1,1-Dichloroethene	61-145	59-173	14	22
Trichloroethene	71-120	62-137	14	23
Benzene	76-127	66-142	11	21
Toluene	76-125	59-139	13	21
Chlorobenzene	75-130	60-133	13	21
Pesticides/PCBs				
$\gamma$ -BHC (Lindane)	56-123	46-127	15	50
Heptachlor	40-131	35-130	20	31
Aldrin	40-120	34-132	22	43
Dieldrin	52-126	31-134	18	38
Endrin	56-121	42-139	21	45
4,4'-DDT	38-127	23-134	27	50
Semivolatile Organic Compounds				
Phenol	12-110	26-90	42	35
2-Chlorophenol	27-123	25-102	40	50
1,4-Dichlorobenzene	36-97	28-104	28	27
N-Nitroso-di-N-propylamine	41-116	41-126	38	38
1,2,4-Trichlorobenzene	39-98	38-107	28	23
4-Chloro-3-Methylphenol	23-97	26-103	42	33
Acenaphthene	46-118	31-137	31	19
4-Nitrophenol	10-80	11-114	50	50
2,4-Dinitrotoluene	24-96	28-89	38	47
Pentachloropheneol	9-103	17-109	50	47
Pyrene	26-127	35-142	31	36

Table 4-1

## SAMPLE CONTAINER RECOMMENDATIONS

<u>Container Type</u>	<u>Specifications</u>
A <u>Container:</u> <u>Closure:</u>	80oz amber glass ring handle bottle/jug black phenolic baked polyethylene cap, 0.015 teflon liner
B <u>Container:</u> <u>Closure:</u> <u>Septum:</u>	40ml glass vial black phenolic open-top screw cap disc of .005 inch Teflon bonded to .120 in silicon for total thickness of 0.125 inch
C <u>Container:</u> <u>Closure:</u>	1 liter high density polyethylene, cylinder-round bottle. white polyethylene, white ribbed, polyethylene liner
D <u>Container:</u> <u>Closure:</u>	120 ml wide mouth, glass vial white polypropylene cap, 0.015 mm Teflon liner
E <u>Container:</u> <u>Closure:</u>	16 oz tall wide mouth, straight sided, flint glass jar black phenolic, baked polyethylene cap, 0.15 mm Teflon liner
F <u>Container:</u> <u>Closure:</u>	8 oz short, wide mouth, straight sided, flint glass jar black phenolic, baked polyethylene cap, 0.030 mm Teflon liner
G <u>Container:</u> <u>Closure:</u>	4 oz tall, wide mouth , straight-sided, flint glass jar black phenolic, baked polyethylene cap, 0.015 mm Teflon liner
H <u>Container:</u> <u>Closure:</u>	1 liter amber, Boston round glass bottle, pour-out neck finish black phenolic, baked polyethylene cap, 0.015 mm Teflon liner
J <u>Container:</u> <u>Closure:</u>	32 oz tall, wide mouth, straight-sided, flint glass jar black phenolic, baked polyethylene cap 0.015 mm Teflon liner
K <u>Container:</u> <u>Closure:</u>	4 liter amber glass, ring handle bottle/jug black phenolic, baked polyethylene cap, 0.015 mm Teflon liner
L <u>Container:</u> <u>Closure:</u>	500 ml high-density polyethylene, cylinder-round bottle white polyethylene cap, white ribbed, polyethylene liner

**Table 4-2**  
**Sample Container, Preservation and Holding Time Requirements**

Matrix	Analysis	Container	Preservation	Holding Time
<b>Soil/Sediment</b>	Metals	1-8oz WM glass jar	cool to 4° C	6 months, mercury 28 days
	Cyanide	1-8oz WM glass jar	cool to 4° C	14 days
	Volatiles	3-5oz encore tubes *additional 4oz bottle if only doing VOA	cool to 4° C no headspace	14 days
	Semivolatiles	1-8oz WM amber glass jar	cool to 4° C	14 days until extraction, 40 days after extraction
	Pesticides/PCBs	1-8oz WM amber glass jar	cool to 4° C	14 days until extraction, 40 days after extraction
	Total Organic Carbon	1-4oz WM glass jar	cool to 4° C	28 days
<b>Water</b>	Volatiles	2-40ml Septum cap vials	HCL to pH<2, cool to 4° C	14 days
	Semivolatiles	2-1L Amber glass bottle with teflon liner	cool to 4° C	7 days until extraction, 40days after extraction
	Pesticides/PCBs	2-1L Amber glass bottle with teflon liner	cool to 4° C	7 days until extraction, 40days after extraction
	Metals	1-1L Polyethylene bottle	HNO <sub>3</sub> to pH <2	6 months, mercury 28 days
	Cyanide	1-1L Polyethylene bottle	NaOH to pH>12, cool to 4°C	14 days
	Alkalinity	1-1L Polyethylene bottle	cool to 4° C	14 days
	Nitrate/Nitrite	1-250ml Polyethylene bottle		28 days
	Total Dissolved Solids	1-250ml Polyethylene bottle	cool to 4° C	7 days
	Total Suspended Solids	1-250ml Polyethylene bottle	cool to 4° C	7 days
	Total Kieldahl Nitrogen	1-500ml Polyethylene bottle	H <sub>2</sub> SO <sub>4</sub> to pH < 2, cool to 4°C	28 days

TABLE 11-1

## A Synopsis of Equipment Quality Control for the Champaign Laboratory

1.	Balances	Monthly	Use Class "S" weights	If sensitivity is lesser than 0.1 mg, service representative must be called.
2.	Top Loader or Pan Balances	Monthly	Use Class "S" weights	Adjust balance by using Class "S" weights or call service representative.
3.	pH Calibration	Daily or with each use	Check the meter for linearity by using 2 different buffers.	If linearity is out of control, the electrode must be replaced.
4.	Walk-in Refrigerator	Chart checked daily replaced monthly	Chart observation daily	If temperature is erratic, call service representative.
5.	Water Deionizer	Checked	Monitor trace metals and other toxic compounds monthly	Replace cartridge as indicated by manufacturer or as indicated by analytical results.
6.	Drying Ovens	Daily	Check oven thermometers against an NBS or equivalent	Temperature corrections are attached to the oven thermometers.
7.	Atomic Absorption Furnace	Daily Daily As needed Daily Daily	Clean furnace windows Check plumbing connections Change graphite tube Check gases Check autosampler and tubing	
8.	ICAP	Daily Weekly As needed Daily	Check gas flow Change tubing Clean nebulizer Check autosampler and tubing	

TABLE 11-2

## CALENDAR OF ORGANIC LABORATORY EQUIPMENT MAINTENANCE

	<u>Instrument</u>	<u>Procedure</u>	<u>Frequency</u>
1.	Balances:		Every time a standard is prepared or at least monthly
	Analytical Balances	Calibration	
	Top Loader	Calibration	Monthly
	Triple Beam Balances	Calibration	Monthly
	All Balances	Mettler field service	Annually
	All Balances	Reference weight check	Annually
2.	Conductivity Meter:	Calibration with Standard KCl solution	Weekly
		Conductivity cell Cleaning	As required
3.	Nanopure Water System:	Conductivity checked	Daily
4.	Drying Ovens:	Temperature monitoring	Daily
		Temperature calibration	Monthly
5.	Refrigerators/freezers:	Temperature monitoring	Monthly
		Warning system checked	Monthly
		Temperature adjustment	As required
		Defrosting	As required
6.	pH Meter:	pH calibration	Each time pH meter is used
		pH electrode Maintenance	As required
		Specific ion/reference Electrode maintenance	As required
7.	Gas Chromatograph:	Check response with standard mixture, compare to previous data, and file chromatograph	Daily
		Check recorder, electrometer zero, and noise level at operating	Daily

## TABLE 11-2 (Cont.)

<u>Instrument</u>	<u>Procedure</u>	<u>Frequency</u>
	attenuation	
	Check carrier gas flow through column with bubble flow-meter and document in instrument log	Daily
	Check temperature of detector, inlet, column oven and document in instrument log	Daily
	Verify linearity	Daily
	Septom replacement	Every 2 days
	Change carrier gas dried assembly gas cylinders	After every 2
	Visually check for shifting of column packing material resulting in forward movement beyond the bottom of the column exit or settling in excess of a 1/2" from the glass wool plug at the column inlet	Weekly
	Glass wool replacement	As required (Daily if samples being injected are dirty)
	Check glass flow system for leaks using "SNOOP" cylinder change	Monthly and with carrier gas
	Evaluate performance of each column with special standard mixture	Monthly

TABLE 11-2 (Contd)

<u>Instrument</u>	<u>Procedure</u>	<u>Frequency</u>
	Check entire instrument for loose connections and frayed wire insulation	Monthly
	Check all rotometers and flow controllers for proper float action	Monthly
	Column Temperature Verification	Monthly
Electron Capture Detector:	Detector wipe test (N-13)	Every 6 months (May 1 and November 1)
	Detector cleaning	As required
Flame Ionization Detector:	Detector cleaning	As required
Hall 700A Detector:	Electrolyte change	Monthly or as required by noise level
	Reactor tube/Teflon connecting tube change	Every 6 months or as required

8.

Finnigan GC/MS/Data System

This section of the manual contains operator maintenance procedures for the 3200, the 4021, and 5100 GC/MS systems. By performing these procedures at the intervals recommended in the following table, the operator can obtain optimum performance from the system; more detailed information may be found at the beginning of each procedure:

Ion gauge tube degassing	Weekly
High vacuum meter calibration	After degassing
Preamplifier fine zero	Monthly
Pump oil-level check	Monthly
Pump purging	Monthly



TABLE 11-2 (Cont.)

<u>Instrument</u>	<u>Procedure</u>	<u>Frequency</u>
	Pump oil changing	Mechanical pump: at least quarterly Diffusion pumps: annually or when bakeout does not adequately reduce background
	Preamplifier coarse zero	Semi-annually
	Glass jet separator cleaning	When separator becomes clogged
	Analyzer cleaning	If background is too high after bakeout. Dirty or contaminated analyzer components may also produce poor peak shape and require excessive ion energy (over 10 volts) to obtain reasonable sensitivity
	Solid probe inlet maintenance	When O-rings are damaged or leak
	Resolution Adjustment	When peak shape and resolution becomes unsatisfactory or after cleaning the analyzer assembly
	Multiple mass marker calibration	As necessary whenever resolution is changed
	Single mass marker calibration	As necessary whenever resolution is changed
	Analyzer bakeout	When background becomes excessive
	Air filter cleaning	Every 3 months
	Dry System air filter	For INCOS DS: Prefilter, every 30 days; absolute filter, every 3 months

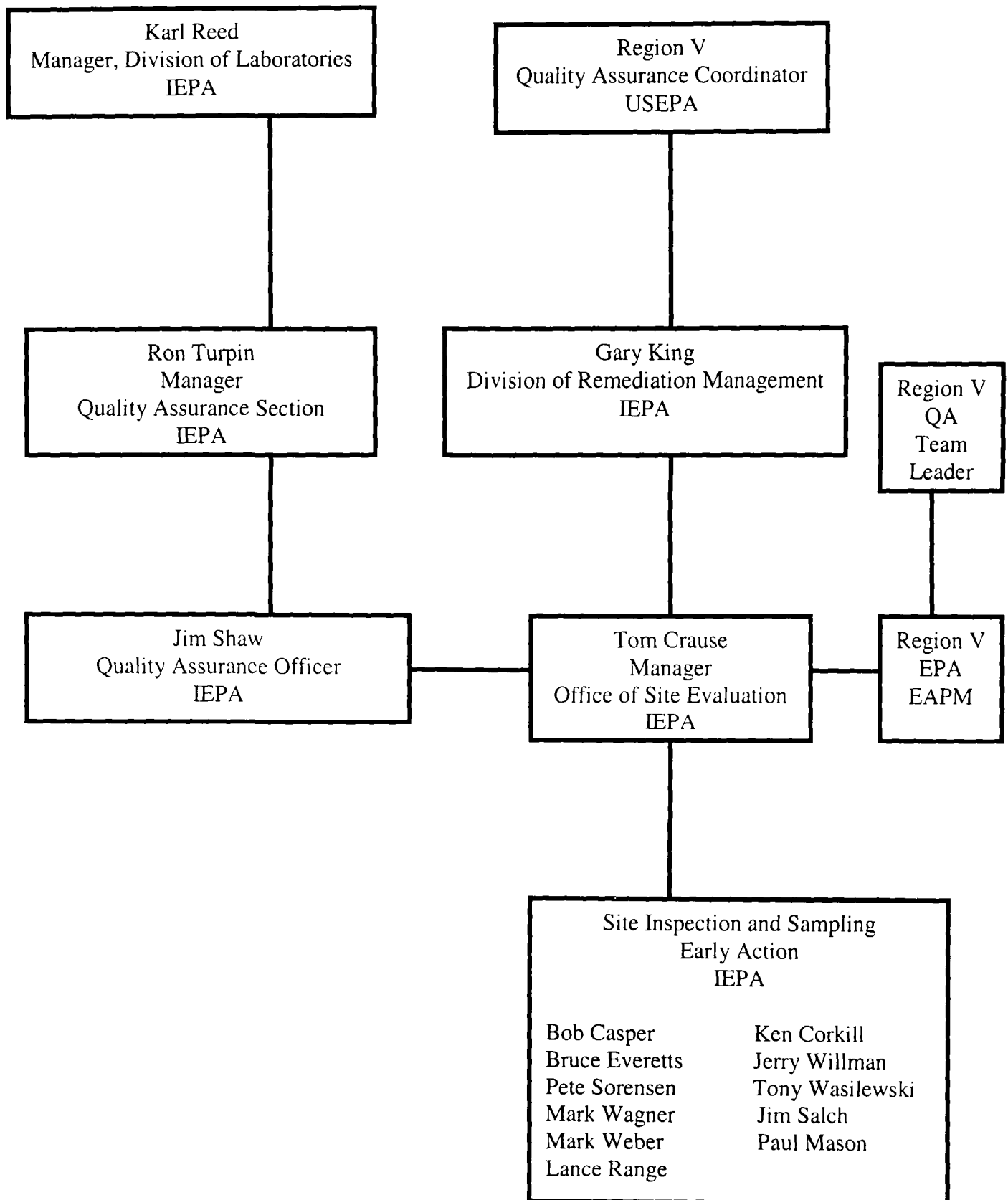
TABLE 11-2 (Cont.)

<u>Instrument</u>	<u>Procedure</u>	<u>Frequency</u>
	Magnetic tape read/write heads	Every 40 hours of use
	TTY Lubrication and cleaning	Every 3 months
Zeta Plotter:	Pen carriage lubrication	Every 3 months
	Paper sprocket cleaning	Every 6 months
	Drive belt lubrication	Yearly
Printronix Printer:	Air filter cleaning	Every 3 months
	Harmer bank cleaning	Every 3 months
	Carriage, Counter Balance, Anti-Rotation arm and O-ring lubrication	Every 3 months

# **APPENDIX B**

## **FIGURES**

Figure 4-1  
Chart of Organization



## **APPENDIX C**

# **IEPA BUREAU OF LAND SAMPLING PROCEDURES GUIDANCE MANUAL**

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# **Bureau of Land**

## **Sampling Procedures Guidance Manual**

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**Illinois Environmental  
Protection Agency**



**September 1996**

**OCT 16 2001**

**EPA-111-1-101**

# **BUREAU OF LAND**

## **SAMPLING PROCEDURES GUIDANCE MANUAL**

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# **SECTION I. INTRODUCTION**

## **A. PURPOSE**

In the past the Agency has been challenged in court cases on the validity of data on the grounds that sampling and preservation procedures varied from person to person. In an effort to ensure samples are collected in a consistent manner to produce data that reflects actual site conditions, the Bureau of Land (BOL) formed a technical work group to develop a basic sampling procedures guidance manual. This manual contains sections which provide commonly accepted methods for collecting samples of the various media encountered at a site during an inspection. The following fourteen (14) sections of this manual will assist BOL personnel in collecting samples. The manual is not intended to contain all possible or innovative sampling methods, nor direct the sampler in determining the number and location of samples.

The Sampling Technical Work Group has included as much information as possible in a concise easy to use format, designed to be used in planning while in the office and executing a successful sampling event in the field. Most sections contain reminder checklists, an essential equipment checklist, and step by step sample collection procedures. The reminder checklists in particular are designed to assist BOL personnel in planning, executing, and completing a successful sampling event.

## **B. DISCLAIMER**

The procedures presented in this manual are not final agency action, but are intended solely as guidance. These procedures are intended for use by IEPA-BOL personnel and should not be distributed to individuals, Agency contractors, and/or engineering/consultant firms outside the agency. IEPA-BOL personnel may decide to follow the guidance provided in this manual, or act at variance with the guidance, based on an analysis of specific site circumstances. IEPA also reserves the right to revise this guidance any time to include improvements in existing procedures or any new sampling methods available to the agency.



## **SECTION II: TANK SAMPLING**

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## SECTION II: TANKS

### A. REMINDER CHECKLIST

#### 1. Pre-Sampling Activities

- \_\_\_ Assess site hazards and develop and/or review a safety plan.
- \_\_\_ Establish purpose(s) of sampling.
- \_\_\_ Develop and/or review a sampling plan.
- \_\_\_ Obtain necessary sampling and monitoring equipment; decontaminate or pre-clean the equipment and ensure that it is in working order.
- \_\_\_ Bring enough clean water for rinsing, cleaning and cooling off.
- \_\_\_ Schedule lab time and order your bottles 2 weeks in advance.
- \_\_\_ Be prepared to sample in extreme weather conditions, if applicable.
- \_\_\_ Schedule a meeting prior to the trip to ensure all sampling team members understand their roles and responsibilities.
- \_\_\_ If necessary, contact owner/operator prior to the trip to schedule the sampling event, to gain access to the site, to discuss the purpose of the sampling event, and to address any safety and security concerns at the site.
- \_\_\_ Identify local suppliers of sampling expendables (e.g. ice, plastic bags) and overnight delivery services (e.g. Federal Express), and recharge of SCBA air tanks (local Fire Dept.).
- \_\_\_ Prepare site map indicating the location of tanks to be sampled.
- \_\_\_ Determine if site owner or operator will be splitting samples.
- \_\_\_ Prior to opening a tank for internal inspection, the tank sampling team should:
  - \_\_\_ Ensure the tank is properly grounded.
  - \_\_\_ Remove all sources of ignition from the immediate area.

- \_\_\_ If possible, request that the owner/operator open the tank for you.
- \_\_\_ Each tank should be mounted using appropriate means. Remove man-way covers using non-sparking tools.
- \_\_\_ The tank headspace should be cleared of any toxic or explosive vapor concentration using a high volume blower.
- \_\_\_ Prepare your sample containers prior to sampling (label and organize).

## 2. During Sampling Activities

- \_\_\_ Document the sampling event. At a minimum, include: weather conditions, date, time, sampler's name, photographs, sample appearance (e.g. color), any deviations from the original sampling plan, and any problems encountered.
- \_\_\_ Collect samples in order of volatilization. Special care is taken when collecting VOC samples.
- \_\_\_ If necessary, monitor the air in the area where sampling is taking place so that you can adjust your level of protection.
- \_\_\_ Keep sample bottles in coolers properly preserved, sealed and maintain chain of custody.
- \_\_\_ Never composite VOC samples.
- \_\_\_ Wipe off outside of sample bottles prior to placement in cooler.
- \_\_\_ Using a weighted tape measure, probe line, sludge judge, or equivalent to determine depth of any and all liquid-solid interface, and depth of sludge.
- \_\_\_ For liquids < 5 feet deep use a glass thief or COLIWASA to collect a sample.
- \_\_\_ Using a subsurface grab sampler or bacon bomb, collect liquid samples from one(1) foot below the surface, from mid-depth of liquid, and from one (1) foot above the bottom sludge layer.
- \_\_\_ Use bacon bomb to determine if the material is stratified.
- \_\_\_ In sampling a tank which is less than full and beyond the reach of standard

equipment design, the sampler may need to improvise. A site visit prior to the sampling event is suggested to make a determination of the equipment and/or modification(s) required.

- If sampling storage tanks, vacuum trucks, or process vessels, collect at least one sample from each compartment in the tank.
- Samples should always be collected through an open hatch at the top of the tank.
- Due to questionable or unknown integrity: **DO NOT USE VALVES NEAR THE BOTTOM OF THE TANK.** It may be that, once opened, the valves may not close and result in a release. Also, individual strata cannot be sampled separately through a valve near the bottom.
- Compare the three samples for visual phase differences. If phase differences appear, systematic additional sampling should be performed. To determine the depth phase change the distance between two (2) discrete samples should be halved.
- If another sampling port is available, sample as above to verify the phase information.
- Measure the outside diameter of the tank and determine the volume of wastes using the depth measurements (Figure 2a & b).
- Collect sludge samples by using a bacon bomb, glass thief, or sludge judge.

### 3. Post-Sampling Activities

- Decontaminate all field equipment and PPE if appropriate, in accordance with the Health and Safety Plan. Return all reusable equipment to the IEPA warehouse or its place of origin.
- Classify all waste generated (i.e., IDW = cuttings, rinse waters, baggies, contaminated PPE).
- Keep samples cool; ship or drop off to appropriate laboratory in accordance with BOL SOP for Sample Packaging and Shipping.
- Separate incompatible wastes samples so that they are not transported in the cooler.

- \_\_\_\_ Seal odorous wastes in a cooler to avoid breathing vapors or odors during transportation.

## **B. EQUIPMENT CHECKLIST**

The selection of the sampling devices should be based upon waste properties (e.g., liquid or solid), site factors (e.g., waste accessibility, waste generation practices, and degree of hazard), and the analytes to be quantitated (e.g., VOCs or heavy metals). Ease of use under the site conditions and the degree of hazard associated with using a given device should also be considered. See the next page for a sampling equipment checklist for a list of the equipment used for sampling.

## **SAMPLING EQUIPMENT CHECKLIST:**

### **TANKS**

#### **PAPERWORK:**

- ☐ IEPA Identification
- ☐ Safety Training Certification
- ☐ Lab Phone Numbers
- ☐ Site Map & Directions
- ☐ Chemical Analysis Forms
- ☐ Chain of Custody Forms
- ☐ Receipt for Samples (RCRA sites only)
- ☐ Field Log Forms or Field Log Book
- ☐ Site Safety Plan

#### **PROJECT MANAGER:**

- ☐ Field Logbook
- ☐ Agency Phone Book
- ☐ Aluminum Case (for paperwork)
- ☐ Calculator
- ☐ Camera
- ☐ Camera Batteries
- ☐ Extra Film
- ☐ Pencils & Pens (Waterproof)
- ☐ China Markers
- ☐ Compass
- ☐ Pocket Knife
- ☐ Emergency Raingear
- ☐ Paper Towels
- ☐ PPE Gloves ☐ L ☐ XL
- ☐ pH Paper
- ☐ Decon Spray Bottles:
  - ☐ Liquinox Solution
  - ☐ Deionized/Distilled Water

#### **GENERAL SAMPLING EQUIPMENT:**

- ☐ Sample Bottles
- ☐ Extra Bottle Labels
- ☐ Waterproof Clear Tape
- ☐ Visqueen (pre-cut)
- ☐ Utility Knife or Pocket Knife
- ☐ Portable Table
- ☐ Garbage Bags
- ☐ Rain Canopy & Poles
- ☐ Nylon Rope
- ☐ Water Carriers
- ☐ Paper Towels
- ☐ Duct Tape
- ☐ Masking Tape
- ☐ Flashlights & Batteries
- ☐ Binoculars
- ☐ Aluminum Foil
- ☐ Shovel
- ☐ Trowel/Sampling Spoons
- ☐ Machete

#### **FOR DECON:**

- ☐ Spray Bottles:
  - ☐ Liquinox Solution
  - ☐ Distilled/Deionized Water
- ☐ 1/2-Gallon Jugs:
  - ☐ HCL; dilute to 5 or 10%
  - ☐ Liquinox Solution
  - ☐ DI Water
- ☐ 5-Gallon Sprayers:
  - ☐ Liquinox Solution
  - ☐ Tap Water
  - ☐ Extra Gallons of DI Water
- ☐ Paper Towels
- ☐ Aluminum Foil
- ☐ Brushes
- ☐ Plastic Tubs
- ☐ 5-Gallon Plastic Buckets
- ☐ Garbage Bags

#### **FOR FIELD MEASUREMENTS:**

- ☐ Passport
- ☐ PID
- ☐ FID
- ☐ TVA
- ☐ pH/Temp/Millivolt Meter
  - ☐ Battery: 9-volt
  - ☐ pH Buffers; 4, 7, & 10
- ☐ Radiation Detector
- ☐ Draeger Pump, Tubes

#### **PPE, SAFETY & SUPPORT:**

- ☐ Cleaning & Cooling Water
- ☐ Drinking Water
- ☐ Gatorade
- ☐ Ice for Drinking Water
- ☐ Hand Soap/Goop
- ☐ First Aid Kit
- ☐ Insect/Tick Repellent
- ☐ Sunscreen
- ☐ Fire Extinguishers
- ☐ Walkie Talkies
- ☐ Full-Face Respirators
- ☐ Cartridges
- ☐ SCBAs
- ☐ Cylinders
- ☐ Safety Glasses
- ☐ Disposable Booties
- ☐ Tyvek
- ☐ Saranex
- ☐ Raingear
- ☐ Cotton Coveralls
- ☐ Insulated Coveralls
- ☐ Steel-Toed/Shanked Boots
- ☐ Insulated Pack-Boots
- ☐ Hardhat/Face Shields
- ☐ Nitrile/Butyl Rubber/Neoprene Gloves
- ☐ Glove Liners

#### **SEALING & TRANSPORTATION**

- ☐ Coolers
- ☐ Blue Ice
- ☐ Dry Ice
- ☐ Regular Ice
- ☐ Large Liners for Coolers
- ☐ 1-Gallon Ziplock Bags
- ☐ Quart Ziplock Bags
- ☐ Large FDA Cooler Bags
- ☐ Evidence Tape
- ☐ Strapping Tape
- ☐ Tie Wraps
- ☐ Vermiculite

#### **TANK SAMPLING EQUIPMENT**

- ☐ Glass Thief
- ☐ COLIWASA
- ☐ Bacon Bomb
- ☐ Sludge Judge
- ☐ Subsurface Grab Sampler
- ☐ Bailer (inert volatile bailer)
- ☐ Non-sparking Tools
- ☐ Chem Wipes
- ☐ Bailer Cord

## C. PROCEDURES

**NOTE:** In many instances a tank containing waste material will have a sludge layer on the bottom. Slow insertion of the sample tube down into this layer and with gradual withdrawal will allow the sludge to act as a bottom plug to maintain the fluid in the tube. The plug can be gently removed and placed into the sample container by use of a stainless steel lab spoon.

1. **Glass Thief:** due to the size of the equipment, is limited to use in small tanks only. **NOTE:** Be careful, this tool is fragile and can be easily broken (Figure 2c).
  - a. Open the sample container(s) provided by the laboratory.
  - b. Insert glass thief almost to the bottom of the tank or until a solid layer is encountered. Note: About one (1) foot of the tubing should extend above the tank.
  - c. Allow the waste in the tank to reach its natural level in the tube.
  - d. Cap the top of the glass thief with a tapered stopper or thumb of a gloved hand, ensuring liquid does not come into contact with the stopper.
  - e. Carefully remove the capped glass thief from the tank with one hand while wiping the sampler with a disposable cloth, rag, or wipe with the other hand and insert the uncapped end in the sample container.
  - f. Release the stopper draining the glass thief and filling the sample container per laboratory requirements.
  - g. Return unused portion of retrieved sample to the tank and dispose of sampler properly.
  - h. Cap the pre-labeled sample container(s) tightly and place in the cooler.
  - i. Close the tank cover.
2. **COLIWASA (Complete Liquid Waste Sampler):** is a piece of equipment designed to collect a sample from the full depth of a tank and maintain it in the transfer tube until delivery to the sample bottle (Figure 2d).
  - a. Open the sample container(s) provided by the laboratory.

- b. Put the sampler in the open position by placing the stopper rod handle in the T-position and pushing the rod down until the handle sits against the sampler's locking block.
- c. Slowly lower the sampler into the liquid waste at a rate that permits the levels of the liquid inside and outside the sampler tube to be about the same. Note: If the level of the liquid in the sample tube is lower than that outside the sampler, the sampling rate is too fast and the sample will not be representative.
- d. When the sampler stopper hits the bottom of the waste tank, push the sampler tube downward against the stopper to close the sampler. Lock the sampler in the closed position by turning the T-handle until it is upright and one end rests tightly on the locking block.
- e. Slowly withdraw the sample from the waste tank with one hand while wiping the sampler tube with a disposable cloth or rag with the other hand.
- f. Carefully fill the sample container by slowly pulling the lower end of the T-handle away from the locking block while the lower end of the sampler is positioned in a sample container.
- g. Return unused portion of sample to the tank and dispose of sampler properly.
- h. Cap the pre-labeled sample container(s) tightly and place in the cooler.
- i. Close the tank cover.

3. **Bacon Bomb Sampler:** is designed to collect material from various levels in a tank (Figure 2e).

- a. Open the sample container(s) provided by the laboratory.
- b. Attach the sample line and plunger line to the sampler.
- c. Measure and then mark the sampling line at a predetermined distance below the entry port using either a colored laboratory marker or tape or equivalent device. Do not allow the marked area to enter the tank.
- d. Gradually lower the sampler by the sample line until the desired level is reached.



- e. Pull up on the plunger line to fill the sampler and release the plunger line to seal the sampler.
  - f. Slowly remove the sampler by pulling up on the sample line and wipe the exterior of the sampler with a disposable wipe, clean cloth or wipe then transfer the contents to a sample container.
  - g. Return unused portion of sample to the tank and dispose of sampler properly.
  - h. Cap the pre-labeled sample container(s) tightly and place in a cooler.
  - i. Close the tank cover.
4. **Sludge Judge:** is used for obtaining an accurate reading of settled solids, in any liquid, to any depth. The sampler consists of 3/4-inch plastic pipe in five (5) foot sections, marked at one (1) foot increments, with screw-style fittings (Figure 2f).
- a. Open the sample container(s) provided by the laboratory.
  - b. Lower the sludge judge to the bottom of the tank.
  - c. After the sampler has reached bottom and the pipe has filled to surface level, tug slightly on the rope to seat the check valve trapping the material and raise the sampler.
  - d. After raising the sampler clear of the tank liquid, read the amount of sludge in the sample using the one (1) foot increments marked on the pipe sections.
  - e. Before transfer to a sample container, wipe the exterior of the sampler with a disposable chem wipe or other laboratory grade wipe, disposing of the wipe properly.
  - f. Touch the pin extending from the bottom section against a hard surface to release the material from the sampler and empty the material into the sample container.
  - g. Return unused portion of sample to the tank and dispose of the sampler properly.
  - h. Cap the pre-labeled sample container(s) tightly and place in a cooler.

- i. Close the tank cover.
5. **Subsurface Grab Sampler:** is designed to collect samples of liquids at various depths. The sampler is usually constructed of aluminum or stainless steel tubing with a polypropylene or Teflon head that attaches to a one (1) liter sample container (Figure 2g).
- a. Open the sample container(s) provided by the laboratory.
  - b. Screw the sample bottle onto the sampling head.
  - c. Measure and then mark the sampling line at a predetermined distance below the entry port using either a colored laboratory marker or tape or equivalent device. Do not allow the marked area to enter the tank.
  - d. Pull the ring at the top which opens the spring-loaded plunger in the head assembly.
  - e. When the bottle is full, release the ring, lift the sampler, and remove sample bottle. Wipe the exterior of the sampler and sampler bottle with a disposable wipe, clean rag or cloth and dispose of wipe or rag properly.
  - f. Pour the contents into the sample container(s).
  - g. Cap the pre-labeled sample container(s) tightly and place in a cooler.
  - h. Close the tank cover.
6. **Bailer:** is the positive-displacement chemically inert volatile sampling bailer. Other bailer types (messenger, bottom, fill, etc.) are less desirable, but may be mandated by cost and site conditions (Figure 2h).
- a. Open the sample container(s) provided by the laboratory.
  - b. Due to the potential of dripping and spillage, lay out clean plastic sheeting around tank, specifically in the vicinity of the sampling port.
  - c. Lower the bailer slowly and gently into the tank so as not to splash the bailer into the tank contents.
  - d. Allow the bailer to fill completely and remove from the tank with one hand while wiping the exterior of the sampler with a disposable wipe.

- e. Slowly pour the contents of the bailer into the sample container(s).
- f. Return the unused portion of the sample to the tank and dispose of sampler properly.
- g. Cap the pre-labeled sample container(s) tightly and place in a cooler.
- h. Close tank cover.

## **D. REFERENCES**

Reproduced in part from OSWER Directive 9360.4-03, January 1991.

## **E. FIGURES**

2a -- Various Volume Calculations

2b -- Various Volume Calculations (contd.)

2c -- Glass Thief

2d -- COLIWASA (Complete Liquid Waste Sampler)

2e -- Bacon Bomb

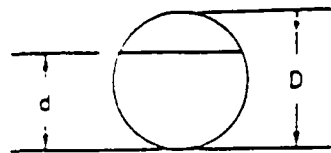
2f -- Sludge Judge

2g -- Subsurface Grab Sampler

2h -- Bailer

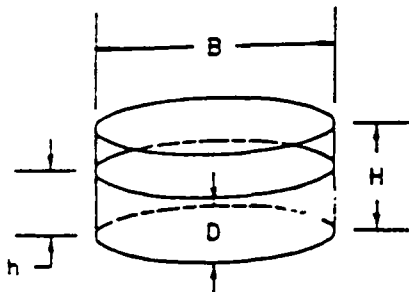
**FIGURE 2a -- VARIOUS VOLUME CALCULATIONS**

SPHERE



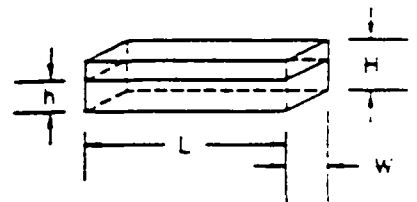
Total Volume  
 $V = 1/6 \pi D^3 = 0.523498 D^3$   
 Partial Volume  
 $V = 1/3 \pi d^2 (3/2 D - d)$

ELLIPTICAL CONTAINER



Total Volume  
 $V = \pi B D H$   
 Partial Volume  
 $V = \pi B D h$

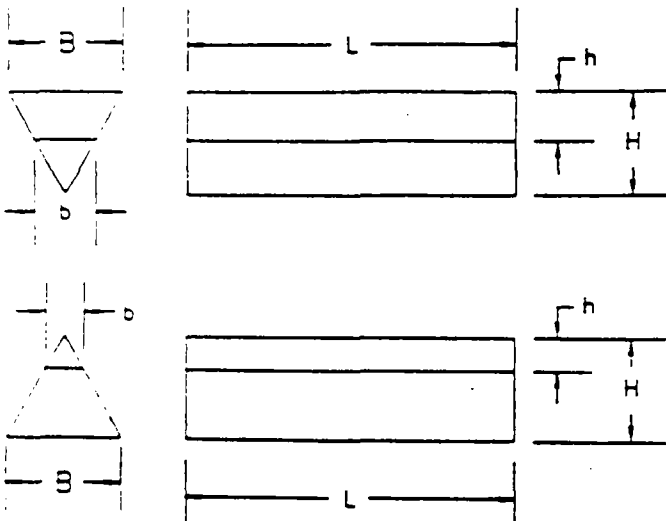
ANY RECTANGULAR CONTAINER



Total Volume  
 $V = H L W$   
 Partial Volume  
 $V = h L W$

TRIANGULAR CONTAINER

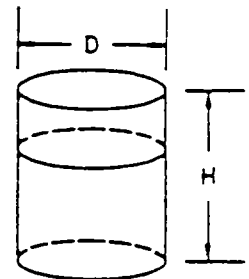
Total Volume  
 $V = 1/2 H B L$



Case 1  
 Partial Volume  
 $V = 1/2 h B L$

Case 2  
 Partial Volume  
 $V = 1/2 L (H B - h B)$

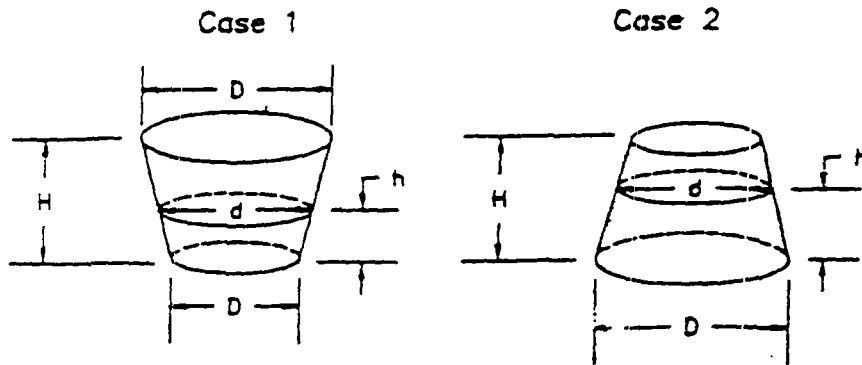
RIGHT CYLINDER



Total Volume  
 $V = 1/4 \pi D^2 H$   
 Partial Volume  
 $V = 1/4 \pi D^2 h$

**FIGURE 2b – VARIOUS VOLUME CALCULATIONS (cont'd.)**

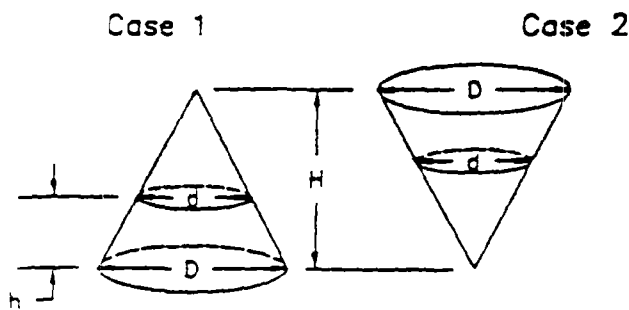
FRUSTUM OF A CONE



Total Volume  
 $V = \pi/12 H(D_1^2 + D_1 D_2 + D_2^2)$

Partial Volume  
 $V = \pi/12 h(D_1^2 + D_1 d + d^2)$

CONE

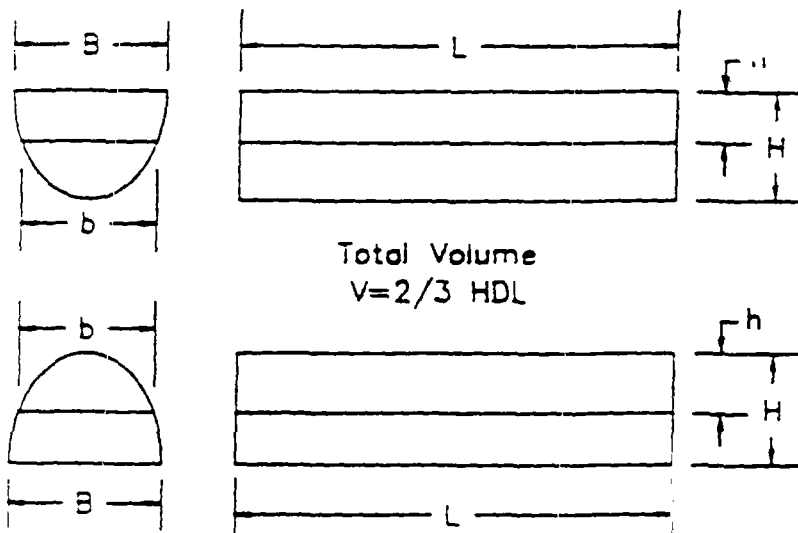


Total Volume  
 $V = \pi/12 \cdot D^2 H$

Partial Volume Case 1  
 $V = \pi/12 \cdot d^2 h$

Partial Volume Case 2  
 $V = \pi/12 \cdot (D^2 H - d^2 h)$

PARABOLIC CONTAINER

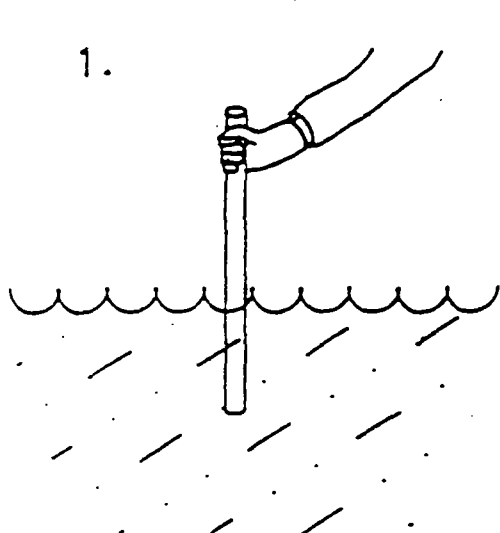


Total Volume  
 $V = 2/3 HDL$

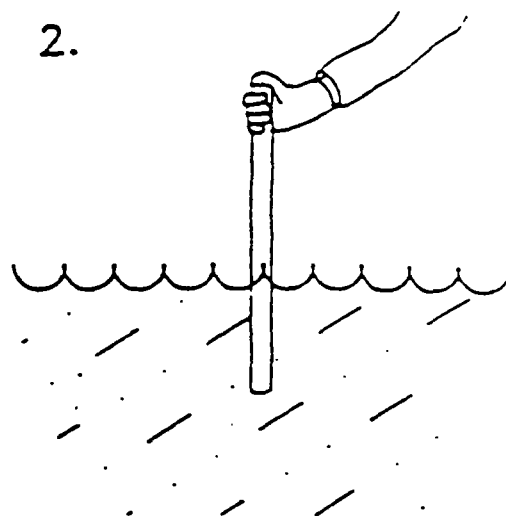
Case 1  
 Partial Volume  
 $V = 2/3 h d L$

Case 2  
 Partial Volume  
 $V = 2/3 (HD - hd) \cdot L$

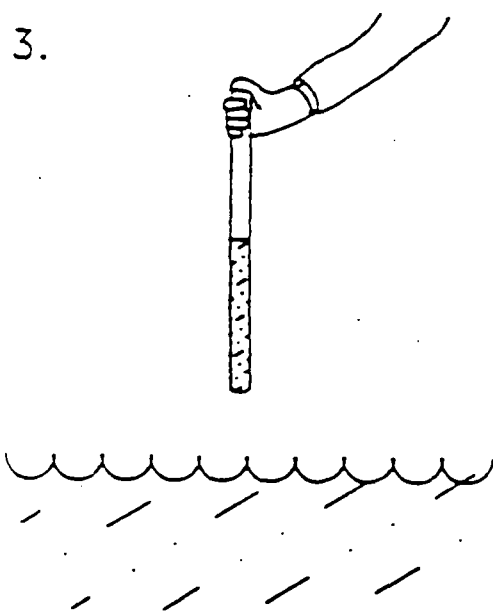
**FIGURE 2c -- GLASS THIEF**



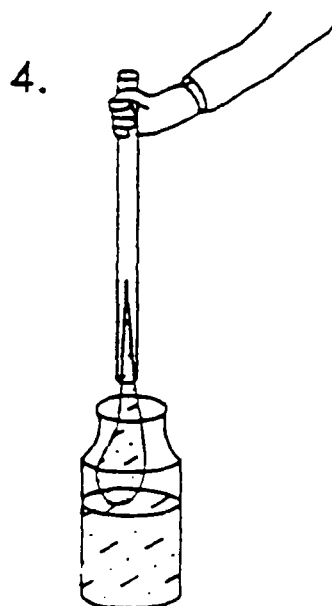
Insert open tube (thief) sampler in containerized liquid.



Cover top of sampler with gloved thumb.

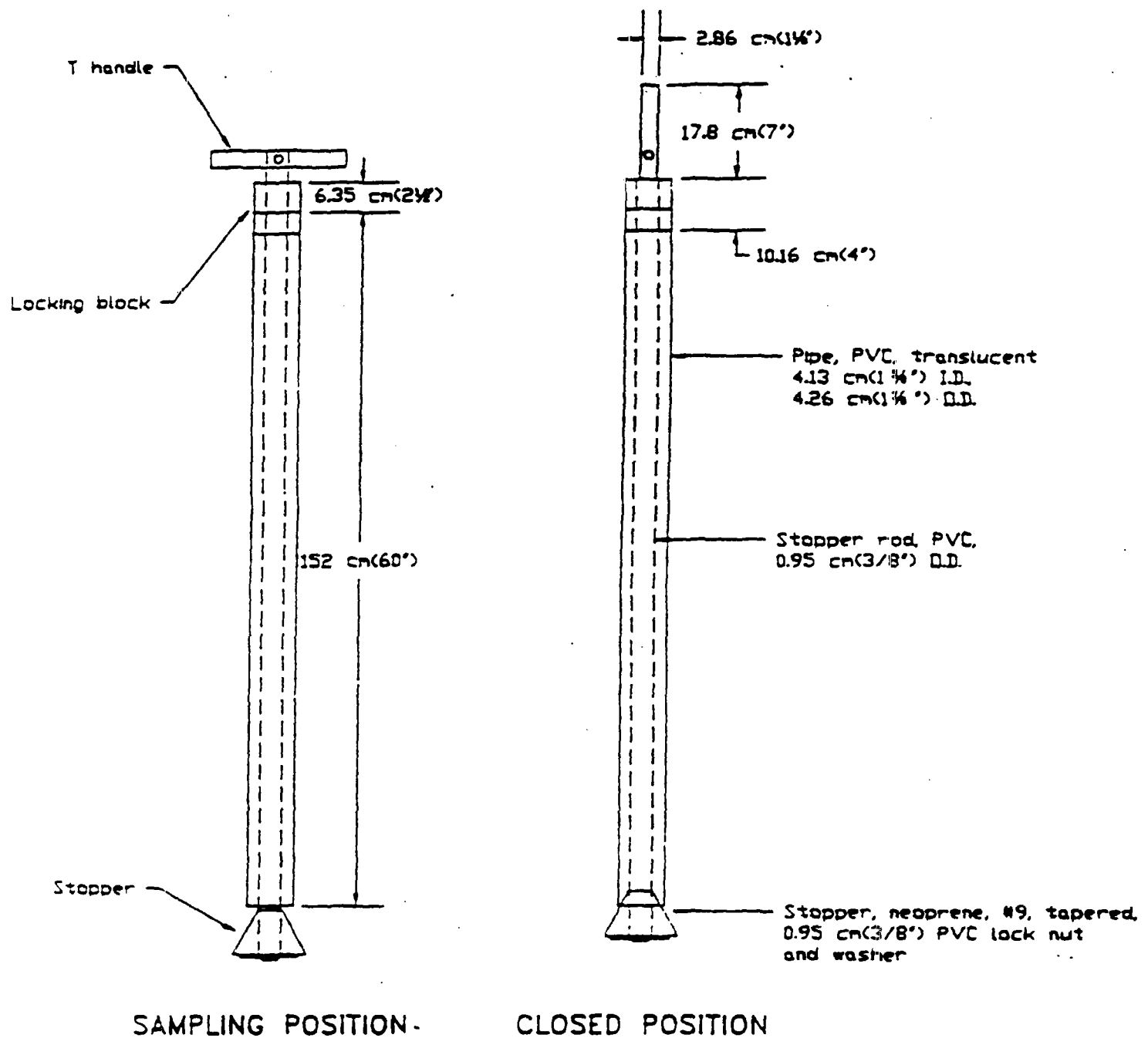


Remove open tube (thief) sampler from containerized liquid.

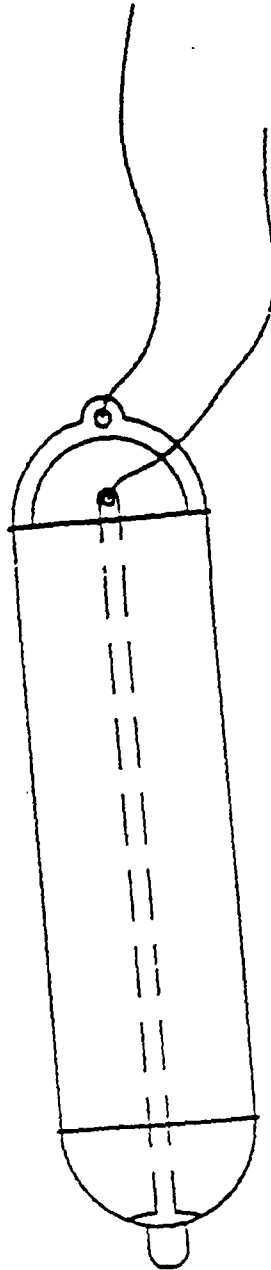


Place open tube sampler over appropriate sample bottle and remove gloved thumb.

**FIGURE 2d – COLIWASA (Complete Liquid Waste Sampler)**

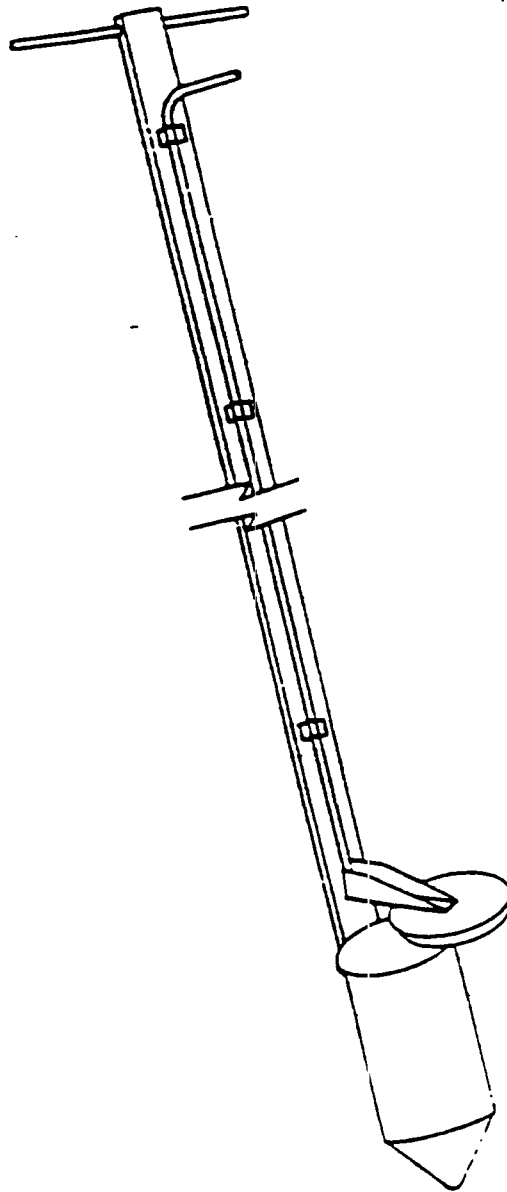


**FIGURE 2e – BACON BOMB**

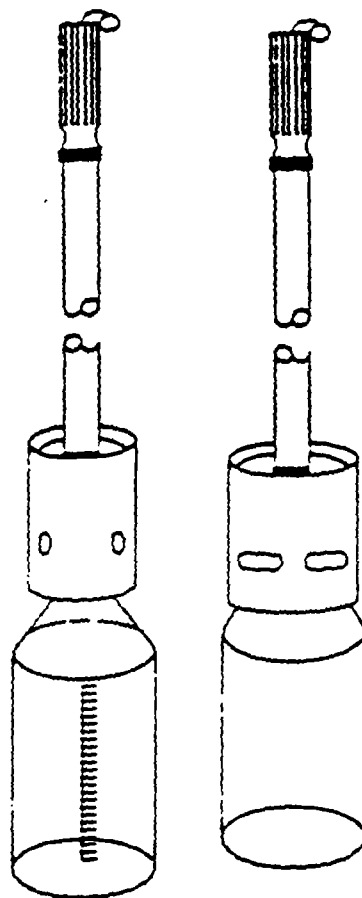




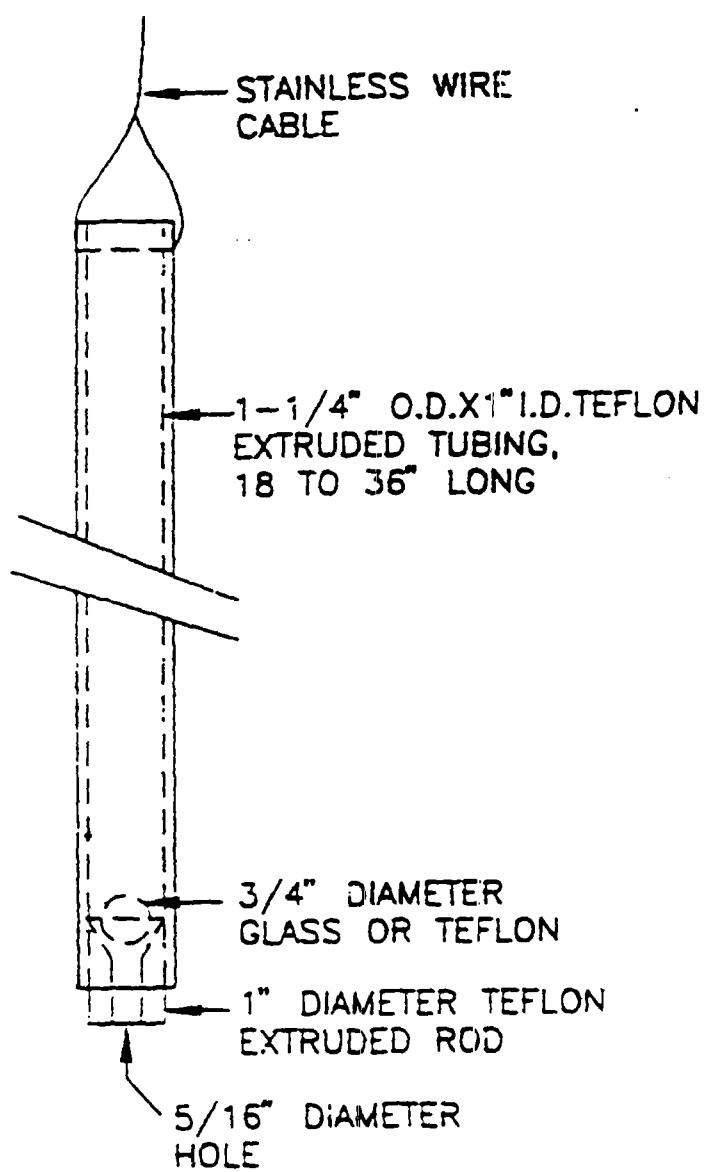
**FIGURE 2f – SLUDGE JUDGE**



**FIGURE 2g -- SUBSURFACE GRAB**



**FIGURE 2h - BAILER**



# **SECTION III: CONTAINER SAMPLING**

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## SECTION III: CONTAINER SAMPLING

### DEFINITION OF CONTAINER

Any portable device in which a (liquid or solid) material is stored, transported, treated, disposed of, or otherwise handled. Containers include 55 gallon or smaller drums, dumpsters, tanker trucks or trailers, totes, bags, sacks, jugs, cans, bottles, and vials, among others.

***DANGER:*** *The opening of closed containers is one of the most hazardous site activities. Maximum efforts should be made to ensure the safety of the sampling team. Proper protective equipment and a general wariness of the possible dangers will minimize the risk inherent to sampling operations. Employing remote drum opening techniques and equipment whenever feasible is highly recommended.*

### A. REMINDER CHECKLISTS

#### 1. Pre-Sampling Activities

- \_\_\_ Assess site hazards, and develop and/or review a safety plan.
- \_\_\_ Develop and/or review sampling plan.
- \_\_\_ Establish purpose(s) of sampling.
- \_\_\_ Obtain necessary sampling and monitoring equipment, decontaminate or pre-clean the equipment, and ensure that it is in working order.
- \_\_\_ Bring enough clean water for rinsing, cleaning, and cooling off.
- \_\_\_ Schedule lab time and order your bottles 2 weeks in advance.
- \_\_\_ Be aware of OSHA requirements, and prepare for the dangers in moving, opening and closing containers.
- \_\_\_ Be prepared to sample in extreme weather conditions, if applicable.
- \_\_\_ Schedule a meeting prior to the sampling trip to ensure all sampling team members understand the site safety plan, and their roles and responsibilities.

- \_\_\_ If necessary, contact the site owner/operator prior to the trip to schedule the sampling event, to gain access to the site, to discuss the purpose of sampling event, and to address any safety and security concerns at the site.
- \_\_\_ Identify local suppliers of sampling expendables (e.g., ice, plastic bags), and overnight delivery services (e.g., Federal Express), and recharge of SCBA air tanks (local Fire Dept).
- \_\_\_ Re-assess site hazards, weather (including wind direction), and access control at facility location before sampling.
- \_\_\_ Examine containers for visual cues as to contents, e.g., \_\_\_ bulging, \_\_\_ stains, \_\_\_ labels, \_\_\_ symbols, \_\_\_ marks, \_\_\_ container construction, \_\_\_ effects on adjacent ground (Be aware that a drum's label may not describe its contents).
- \_\_\_ Consult chemical guidebooks, available company personnel, Health and Safety Unit personnel, Material Safety Data Sheets, etc., for additional information.
- \_\_\_ Prepare your sample containers prior to sampling (label and organize).

## 2. During Sampling Activities

- \_\_\_ Document the sampling event. At a minimum, include weather conditions, date, time, sampler's name, photographs, any deviations from the original sampling plan, and any problems encountered.
- \_\_\_ Collect samples in order of volatilization. Special care is taken when collecting VOC samples.
- \_\_\_ Never composite VOC samples.
- \_\_\_ If necessary, monitor the air where sampling is taking place so that you can adjust your level of protection.
- \_\_\_ Label (using a paint stick) each container with unique I.D. number.
- \_\_\_ Record descriptions of containers and their contents, their volume, and describe samples, in container log or in field notes.
- \_\_\_ Photograph containers in their original positions, and photograph samples.
- \_\_\_ Wipe off outside of sample bottles prior to placement in cooler.

- \_\_\_ Keep sample bottles in coolers properly preserved, sealed, and maintain chain of custody.
- \_\_\_ Re-evaluate, and if necessary, modify the site safety plan and your procedures if conditions change, problems develop, or additional hazards are discovered while on site for sampling.
- \_\_\_ Halt all sampling activities at the site if an accident or injury occurs, or conditions become too dangerous.

### **3. Post-Sampling Activities**

- \_\_\_ Decontaminate all field equipment and PPE if appropriate, in accordance with the Health and Safety plan. Return all reuseable equipment to the IEPA warehouse or its place of origin.
- \_\_\_ Classify all waste generated (i.e., IDW = cuttings, rinse waters, baggies, contaminated PPE) and dispose of properly.
- \_\_\_ Keep samples cool: ship or drop off to appropriate laboratory.
- \_\_\_ Separate incompatible wastes so that they are not transported in the same cooler.
- \_\_\_ Keep water reactive wastes separated from water or ice.
- \_\_\_ Seal odorous wastes in the cooler to avoid breathing vapors or odors during transportation.

## **B. EQUIPMENT CHECKLIST**

See the attached sampling equipment checklist for a list of the equipment used for sampling containers.

## **SAMPLING EQUIPMENT CHECKLIST:** **CONTAINERS**

### **PAPERWORK:**

- ☐ IEPA Identification
- ☐ Safety Training Certification
- ☐ Lab Phone Numbers
- ☐ Site Map & Directions
- ☐ Chemical Analysis Forms
- ☐ Chain of Custody Forms
- ☐ Receipt for Samples (RCRA sites only)
- ☐ Field Log Forms or Field Log Book

### **PROJECT MANAGER:**

- ☐ Field Logbook
- ☐ Aluminum Case (for paperwork)
- ☐ Calculator
- ☐ Camera, with new or spare batteries
- ☐ Pencils & Pens
- ☐ China Markers
- ☐ Compass
- ☐ Pocket Knife
- ☐ Emergency Raingear
- ☐ Paper Towels
- ☐ PPE Gloves ☐ L ☐ XL
- ☐ pH Paper
- ☐ Decon Spray Bottles:
  - ☐ Liquinox Solution
  - ☐ Deionized/Distilled Water
- ☐ Cellular phone

### **GENERAL SAMPLING EQUIPMENT:**

- ☐ Sample Bottles
- ☐ Extra Bottle Labels
- ☐ Waterproof Clear Tape
- ☐ Visqueen (pre-cut)
- ☐ Utility Knife or Pocket Knife
- ☐ Portable Table
- ☐ Garbage Bags
- ☐ Rain Canopy & Poles
- ☐ Nylon Rope
- ☐ Water Carriers
- ☐ Paper Towels
- ☐ Duct Tape
- ☐ Masking Tape
- ☐ Flashlights & Batteries
- ☐ Binoculars
- ☐ Aluminum Foil
- ☐ Shovel
- ☐ Trowel/Sampling Spoons
- ☐ Machete

### **FOR DECON:**

- ☐ Spray Bottles:
  - ☐ Liquinox Solution
  - ☐ Distilled/Deionized Water
- ☐ 1/2-Gallon Jugs:
  - ☐ HCL; dilute to 5 or 10%
  - ☐ Liquinox Solution
  - ☐ DI Water
- ☐ 5-Gallon Sprayers:
  - ☐ Liquinox Solution
  - ☐ Tap Water
- ☐ Extra Gallons of DI Water
- ☐ Paper Towels
- ☐ Aluminum Foil
- ☐ Brushes
- ☐ Plastic Tubs
- ☐ 5-Gallon Plastic Buckets
- ☐ Garbage Bags

### **FOR FIELD MEASUREMENTS:**

- ☐ Passport
- ☐ PID
- ☐ FID
- ☐ pH/Temp/Millivolt Meter
- ☐ Battery; 9-volt
- ☐ pH Buffers; 4, 7, & 10
- ☐ Radiation Detector
- ☐ Draeger Pump, Tubes
- ☐ TVA

### **PPE, SAFETY & SUPPORT:**

- ☐ Cleaning & Cooling Water
- ☐ Drinking Water
- ☐ Gatorade
- ☐ Ice for Drinking Water
- ☐ Hand Soap/Goop
- ☐ First Aid Kit
- ☐ Insect/Tick Repellant
- ☐ Sunscreen
- ☐ Fire Extinguishers
- ☐ Walkie Talkies
- ☐ Full-Face Respirators
- ☐ Cartridges
- ☐ SCBAs
- ☐ Cylinders
- ☐ Field Chairs
- ☐ Disposable Booties
- ☐ Tyvek
- ☐ Saranex
- ☐ Raingear
- ☐ Cotton Coveralls
- ☐ Insulated Coveralls
- ☐ Steel-Toed/Shanked Eoots
- ☐ Insulated Pack-Boots
- ☐ Hardhat/Face Shields
- ☐ Nitrie/Butyl Rubber/Neoprene Gloves
- ☐ Glove Liners

### **SEALING & TRANSPORTATION:**

- ☐ Coolers
- ☐ Blue Ice
- ☐ Dry Ice
- ☐ Regular Ice
- ☐ Large Liners for Coolers
- ☐ 1-Gallon Ziplock Bags
- ☐ Quart Ziplock Bags
- ☐ Large FDA Cooler Bags
- ☐ Evidence Tape
- ☐ Strapping Tape

### **CONTAINER SAMPLING:**

- ☐ 4 ft. 3/8" dia., clean glass tubes
- ☐ Non-sparking brass or beryllium bung wrench
- ☐ Protective shields (or long handled bung wrenches)
- ☐ Brass drum cutter
- ☐ Absorbent pads
- ☐ Sealer for holes cut in drums
- ☐ Socket wrenches
- ☐ Screwdrivers
- ☐ Pliers
- ☐ Adjustable wrenches
- ☐ Rubber mallet
- ☐ Paint sticks



## **C. PROCEDURES**

### **1. Types of Drums**

The 55 gallon drums you sample will normally be of two types, drums with only bung openings, and drums of the open head type. Open head type drums may also have bung openings. Drums with bung openings only normally contain liquid. Open head type drums normally are used to containerize solids, but can contain liquids as well. Overpack drums are used to contain standard sized 55 gallon or smaller drums that are leaking or damaged. The material the drums are constructed of can also give you clues as to their contents. There are steel, plastic, steel lined with plastic liners, stainless steel and other metal, and fiber drums. Polyethylene or PVC drums, or drums with these types of liners, often contain strong acids or bases. Fiber drums are used to contain dry solids of various characteristics. Exotic metal drums (aluminum, nickel, stainless steel) are very strong and expensive, and are often used to contain extremely dangerous materials. Single walled drums used as a pressure vessel have fittings for the storage product and for an inert gas. These drums may contain reactive, flammable, or explosive substances. Lab pack drums contain a variety of smaller containers within, and may contain incompatible materials, radioisotopes, shock sensitive, or highly volatile, corrosive, or toxic exotic chemicals. Lab packs, or other drums, suspected of containing radioactive, air or water reactive, shock sensitive, or explosive wastes, must not be handled without specialized assistance from the Agency's Health and Safety Unit, and/or an Agency contractor. Gas cylinders of any type or size are not to be opened or sampled.

### **2. Sampling Liquids in Drums Through Bungs**

While taking all the necessary safety precautions, and wearing all the necessary protective gear, you and your sampling partner can sample liquid in sealed drums (through bungs- the small, round stoppers in the round openings on the tops of drums) by the following method:

- a. If it can be done safely, and without causing a leak or spill, position the drum so that the lid and bung(s) are facing up.
  - i. Remember to mark an identification number on the drum with your paint stick.
  - ii. Before you reposition for sampling a drum that was lying on its side, or was upside down, make sure you have a photograph of the drum in its original position.

- b. While staying clear of the bung opening, and using appropriate shields, and/or bung wrench handle extensions, slowly loosen the bung with a non-sparking bung wrench, allowing any gas pressure to release slowly. Leave the immediate area and go upwind while any gas is venting. If visible fumes or vapors are emitted upon opening drums of corrosive wastes, immediately seal the drum back up, and/or leave the area, as appropriate. Return when it is safe to do so.
  - i. Maintain continuous air monitoring in the work area for both organic and inorganic vapors so that you can adjust your level of respiratory or dermal protection as necessary. Monitoring the air in the head space of the drum will help you characterize the general nature of the drum's contents.
  - ii. Do not apply excessive force to a bung if it is too tight. You do not want to break the bung or your wrench, and you do not want to create a spark that will ignite any vapors in or around the drum.
  - iii. Try to open one of the other bungs in the lid, if necessary. Move on to sample another drum if needed. Your safety is more important than any sample.
  - iv. Using the brass drum cutter to cut a sampling hole is a last resort to be used only if it is safe to do so, and if you can seal the hole back up.
- c. Place an absorbent pad on top of the drum to absorb any spills that occur while withdrawing the sample.
- d. Insert a clean glass tube into the drum as far as it will go without breaking, and withdraw the tube while holding your gloved thumb over the top end of the tube.
  - i. Attempt to get a complete cross section of the drum's contents within the tube.
  - ii. Note the depth, appearance, and any stratification of the liquid within the tube.
  - iii. Before you start placing sample into a jar, let some of the waste drip onto some pH paper to check the pH. Adjust your handling of the waste accordingly.

- iv. If any waste has dripped or leaked onto any water pooled on the lid of the drum, or on the ground, note if the waste is miscible or not. Do not deliberately drip or add unidentified waste to water, as it may react violently.
  - v. Don't let the liquid spill off or out of the tube onto the ground, or run down your arm.
  - vi. Let any excess liquid from the tube fall back into the drum. The absorbent pad can catch drippage also.
  - vii. Your sampling partner will have to hold the open sample jar close to the end of the tube after you withdraw it from the drum.
  - viii. Carefully release the contents of the tube into the jar by removing your thumb slowly from the top end of the tube.
  - ix. If solids plug up the end of the tube so that the liquid can not be released, tap the end of the tube gently inside the sample jar until the plug releases.
- e. After obtaining enough sample for your sample jars, close the jars, and discard the used tube into an empty container that can later be sealed. Discarding the used tube into the container that was sampled may be an option if the facility receiving the wastes does not object.
    - i. Don't combine incompatible, contaminated glass tubes, or other incompatible discarded materials in the same container.
    - ii. Discard your absorbent pads in the appropriate manner.
  - f. Reseal the drum as soon as possible after the contents are sampled.

### **3. Sampling Solids in Open Head Type Drums**

While taking all the necessary safety precautions, and wearing all the necessary protective gear, you and your sampling partner can sample solids in sealed open top type drums by the following method. The contents of open drums of any type, of open head type drums whose contents can only be accessed through the bung holes, of dumpsters, etc., can be sampled using variations of the above and following techniques. Heed all of the appropriate safety precautions and warnings previously described for sampling liquids in drums through bungs.

- a. Position the drum so that the top of the drum is facing up. If there is a bung in the lid you can open, open it slowly to release any pressure. Carefully remove the clincher ring, and then the lid.
- b. Maintain continuous air monitoring so that you can adjust your level of protection as necessary.
- c. Insert a glass tube into the solid as far as it will go without breaking, and withdraw the tube. This may allow you to observe any stratification that exists within the solid, or if it is homogenous or heterogenous in nature. You have to take a sufficient number and distribution of samples to adequately address the variation in the waste within the drum.
- d. Collect your sample by inserting a clean stainless steel spoon, or other suitable scooping device into the waste, withdrawing it, and scraping the waste into the sample jar held by your sampling partner. Close the jars when you have collected an adequate volume of sample.
- e. Place your chemically contaminated, and compatible, sampling tools and other discarded materials in a bag or container for later decontamination, or proper disposal.
- f. Reseal the drum as soon as possible after the contents are sampled.

#### **4. Sampling Smaller Containers**

The same sampling techniques used for liquids or solids in drums can be used for sampling smaller containers. With homogenous wastes (i.e., wastes having a uniform composition throughout) in smaller containers, you may be able to pour the contents into the sample jar. This should only be done if you can obtain a representative sample this way, and the lifting or pouring of the container will not jeopardize your safety, or result in a spill. Heed all of the appropriate safety precautions and warnings previously described for sampling liquids in drums with bungs.

#### **5. Sampling Portable Tanks**

Sampling liquids in tanker trucks (which are defined as containers because they are portable) presents unique problems. If the tanker or tanker compartment is small enough, you may be able to use glass tubes in a manner similar to that for drums. Heed all of the appropriate safety precautions and warnings previously described for sampling liquids in drums with bungs. If the tanker or compartment

is too deep for the glass tube technique, you will have to utilize the techniques and tools described for sampling tanks described elsewhere in this manual. Those techniques should allow you to account for the potential stratification of the waste..

## **D. REFERENCES**

"Samplers and Sampling Procedures for Hazardous Waste Streams", USEPA 01/80.

"Test Methods for Evaluating Solid Waste, Volume II: Field Manual", SW846, USEPA11/86.

"Characterization of Hazardous Waste Sites-A Methods Manual, Volume 1-Site Investigations", USEPA 04/85.

"Sampling Procedures Manual", IEPA, DLPC, 04/83.

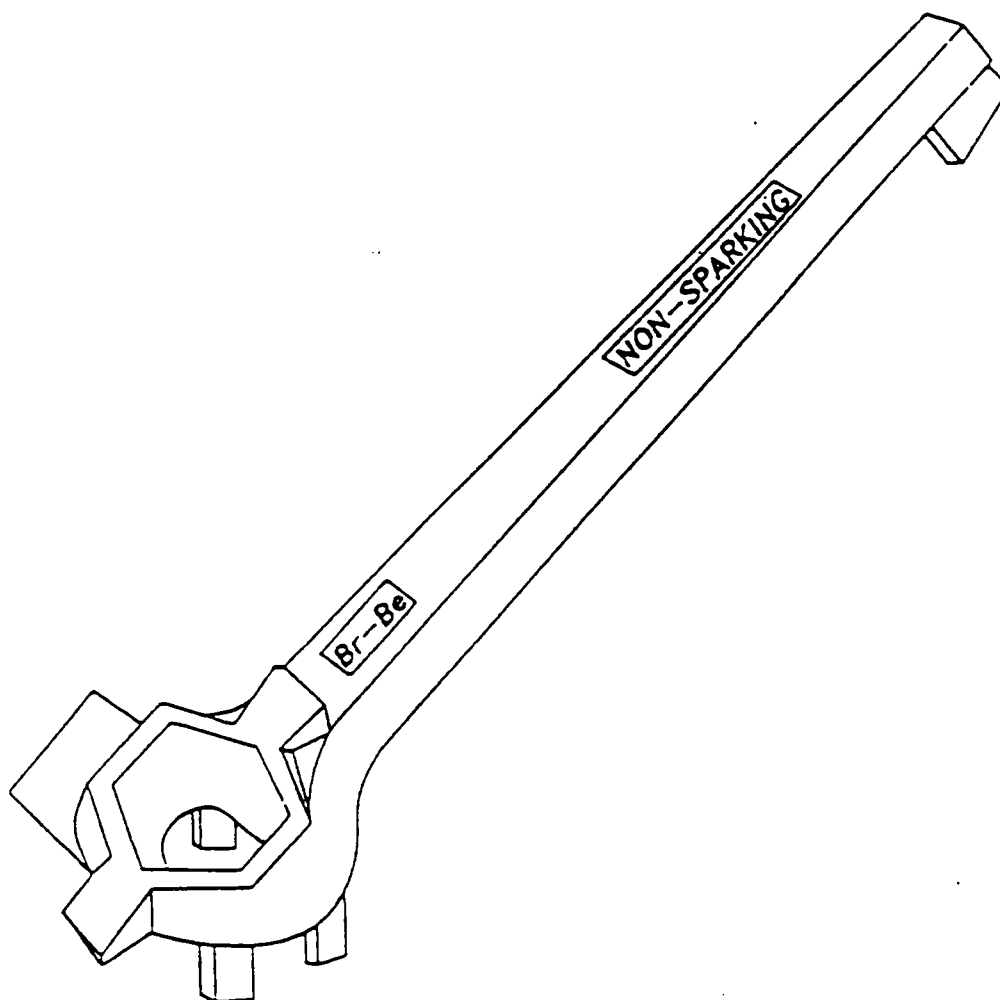
Sampling for Hazardous Materials, USEPA Environmental Response Training Program, 04/95.

## **E. FIGURES**

3a -- Bung Wrench

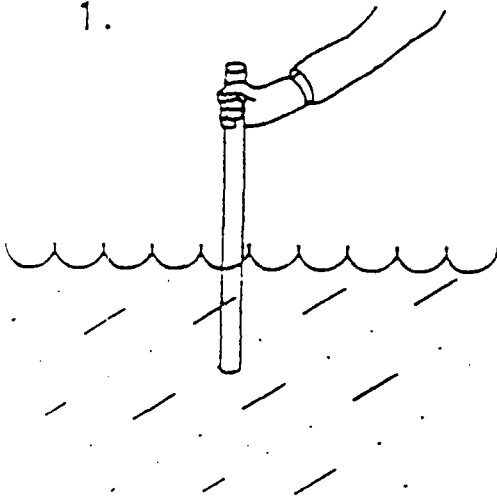
3b -- Glass Thief (Tube)

**FIGURE 3a – BUNG WRENCH**



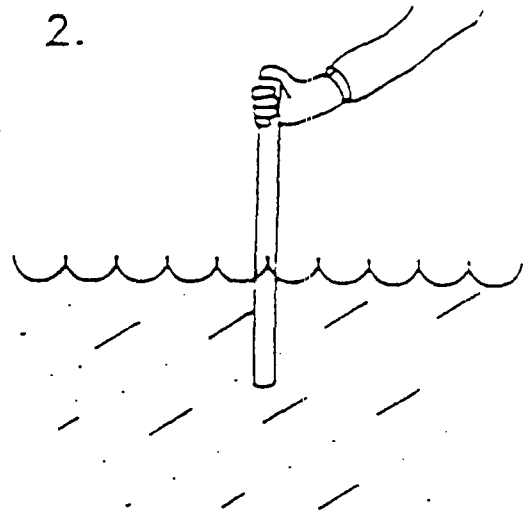
**FIGURE 3b – GLASS THIEF (TUBE)**

1.



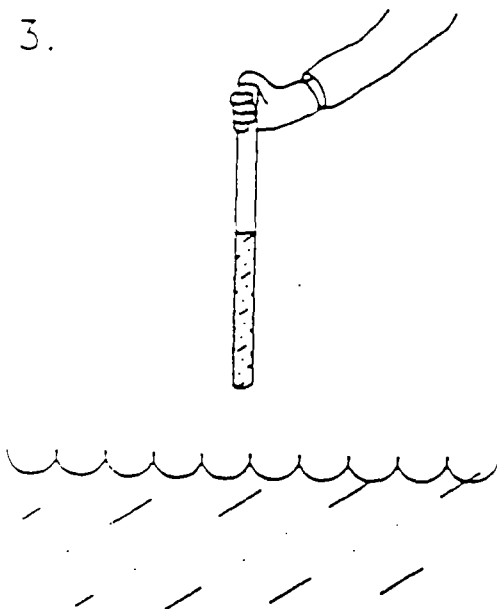
Insert open tube (thief) sampler in containerized liquid.

2.



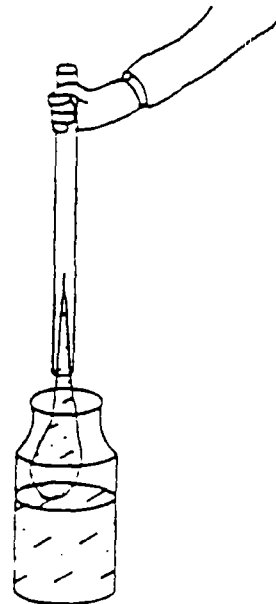
Cover top of sampler with gloved thumb.

3.



Remove open tube (thief) sampler from containerized liquid.

4.



Place open tube sampler over appropriate sample bottle and remove gloved thumb.

# **SECTION IV: SURFACE IMPOUNDMENT SAMPLING**

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## SECTION IV: SURFACE IMPOUNDMENT SAMPLING

### A. REMINDER CHECKLISTS

#### 1. Pre-Sampling Activities

- \_\_\_ Assess site hazards and develop and/or review a safety plan.
- \_\_\_ Develop and/or review a sampling plan.
- \_\_\_ Establish purpose(s) of sampling.
- \_\_\_ Obtain necessary sampling and monitoring equipment; decontaminate or preclean the equipment, and ensure that it is in working order.
- \_\_\_ Bring enough clean water for rinsing, cleaning, and cooling off.
- \_\_\_ Schedule lab time and order your bottles 2 weeks in advance.
- \_\_\_ Be prepared to sample in extreme weather conditions, if applicable.
- \_\_\_ Schedule a meeting prior to the trip to ensure all sampling team members understand their role and responsibilities.
- \_\_\_ If necessary, contact owner/operator prior to the trip to schedule the sampling event, to gain access to the site, to discuss the purpose of the sampling event, and to address any safety and security concerns at the site.
- \_\_\_ Identify local suppliers of sampling expendables (e.g., ice, plastic bags) and overnight delivery services (e.g., Federal Express), and recharge of SCBA air tanks (local Fire Dept.).
- \_\_\_ Become familiar with the impoundment, such as where the waste enters the unit, where the waste exits the unit (if applicable), and accessibility to the unit.
- \_\_\_ If sludge samples are required, refer to Section XI of this document for additional guidance.
- \_\_\_ Prepare your sample containers prior to sampling (label and organize).

## **2. During Sampling Activities**

- \_\_\_ Document the sampling event. At a minimum, include weather conditions, date, time, sampler's name, photographs, any deviations from the original sampling plan, and any problems encountered.
- \_\_\_ Collect samples in order of volatilization. Special care is taken when collecting VOC samples.
- \_\_\_ If necessary, monitor the air in the area where sampling is taking place so that you can adjust your level of protection.
- \_\_\_ Keep sample bottles in coolers properly preserved, sealed and maintain chain of custody.
- \_\_\_ Never composite VOC samples.
- \_\_\_ Wipe off outside of sample bottles prior to placement in cooler.
- \_\_\_ Sample bottles with preservatives cannot be overfilled (liquid samples).
- \_\_\_ Photograph sample containers at sample location.

## **3. Post-Sampling Activities**

- \_\_\_ Decontaminate all field equipment and PPE, if appropriate, in accordance with the Health and Safety Plan. Return all reusable equipment to the IEPA warehouse or its place of origin.
- \_\_\_ Classify all waste generated (i.e., IDW = cuttings, rinse waters, baggies, contaminated PPE) and dispose of properly.
- \_\_\_ Keep samples cool; ship or drop off to appropriate laboratory, in accordance with BOL SOP for Sampling Packaging and Shipping.
- \_\_\_ Separate incompatible wastes so that they are not transported in the same cooler.
- \_\_\_ Seal odorous wastes in the cooler to avoid breathing vapors or odors during transportation.

## **B. EQUIPMENT CHECKLIST**

The selection of the sampling devices should be based upon waste properties (e.g., liquid or solid), site factors (e.g., waste accessibility, waste generation practices, and degree of hazard), and the analytes to be quantitated (e.g., VOCs or heavy metals). Ease of use under the site conditions and the degree of hazard associated with using a given device should also be considered. Refer to the following table to determine equipment needs.

**SAMPLING EQUIPMENT CHECKLIST:**  
**SURFACE IMPOUNDMENTS**

**PAPERWORK:**

- ☐ IEPA Identification
- ☐ Safety Training Certification
- ☐ Lab Phone Numbers
- ☐ Site Map & Directions
- ☐ Chemical Analysis Forms
- ☐ Chain of Custody Forms
- ☐ Receipt for Samples (RCRA sites only)
- ☐ Field Log Forms or Field Log Book

**PROJECT MANAGER:**

- ☐ Field Logbook
- ☐ Aluminum Case (for paperwork)
- ☐ Calculator
- ☐ Camera
- ☐ Camera Battery
- ☐ Pencils & Pens
- ☐ China Markers
- ☐ Compass
- ☐ Pocket Knife
- ☐ Emergency Raingear
- ☐ Paper Towels
- ☐ PPE Gloves ☐ L ☐ XL
- ☐ pH Paper
- ☐ Decon Spray Bottles:
  - ☐ Liquinox Solution
  - ☐ Deionized/Distilled Water

**GENERAL SAMPLING EQUIPMENT:**

- ☐ Sample Bottles
- ☐ Clean Glass Tubes
- ☐ Extra Sample Bottles
- ☐ Extra Bottle Labels
- ☐ Waterproof Clear Tape
- ☐ Visqueen (pre-cut)
- ☐ Utility Knife or Pocket Knife
- ☐ Portable Table
- ☐ Garbage Bags
- ☐ Rain Canopy & Poles
- ☐ Nylon Rope
- ☐ Water Carriers
- ☐ Paper Towels
- ☐ Duct Tape
- ☐ Masking Tape
- ☐ Flashlights & Batteries
- ☐ Binoculars
- ☐ Aluminum Foil
- ☐ Shovel

**FOR DECON:**

- Spray Bottles:**
  - ☐ Liquinox Solution
  - ☐ Distilled/Deionized Water
- 1/2-Gallon Jugs:**
  - ☐ HCL; dilute to 5 or 10%
  - ☐ Liquinox Solution
  - ☐ DI Water
- 5-Gallon Sprayers:**
  - ☐ Liquinox Solution
  - ☐ Tap Water
  - ☐ Extra Gallons of DI Water
- ☐ Paper Towels
- ☐ Aluminum Foil
- ☐ Brushes
- ☐ Plastic Tubs
- ☐ 5-Gallon Plastic Buckets
- ☐ Garbage Bags

**FOR FIELD MEASUREMENTS:**

- ☐ Passport
- ☐ PID
- ☐ FID
- ☐ TVA
- ☐ pH/Temp/Millivolt Meter
- ☐ Battery; 9-volt
- ☐ pH Buffers; 4, 7, & 10
- ☐ Radiation Detector
- ☐ Draeger Pump, Tubes

**PPE, SAFETY & SUPPORT:**

- ☐ Cleaning & Cooling Water
- ☐ Drinking Water
- ☐ Gatorade
- ☐ Ice for Drinking Water
- ☐ Hand Soap/Goop
- ☐ First Aid Kit
- ☐ Insect/Tick Repellant
- ☐ Sunscreen
- ☐ Fire Extinguishers
- ☐ Walkie Talkies
- ☐ Full-Face Respirators
- ☐ Cartridges
- ☐ SCBAs
- ☐ Cylinders
- ☐ Field Chairs
- ☐ Disposable Booties
- ☐ Tyvek
- ☐ Saranex
- ☐ Raingear

**SEALING & TRANSPORTATION:**

- ☐ Coolers
- ☐ Blue Ice
- ☐ Dry Ice
- ☐ Regular Ice
- ☐ Large Liners for Coolers
- ☐ 1-Gallon Ziplock Bags
- ☐ Quart Ziplock Bags
- ☐ Large FDA Cooler Bags
- ☐ Evidence Tape
- ☐ Strapping Tape

**SPECIFIC SAMPLING**

**EQUIPMENT:**

- ☐ Disposable Dippers

## C. PROCEDURES

Note: These procedures should be also followed when collecting liquid and sludge samples from a test pit. The sample collector should also review Section IX (Surface Water) for additional information on liquid sampling procedures.

Make sure appropriate protective gear is worn and all necessary safety precautions are taken prior to collecting samples.

### 1. Liquid Sampling

Most liquid samples are grab samples and are collected by immersing the dipper in the impoundment. A sample of a dipper can be seen on Figure 4a.

Note: Samples for VOC analysis are collected first. When obtaining samples for volatile organic analysis, it is important to exclude any air space in the top of the bottle.

Note: To sample a pond or other standing body of water, the surface area may be divided into grids. A series of samples taken from each grid is combined into one sample, or several grids are selected at random. To conduct this type of sampling, a boat might be necessary, which is not available in the Bureau of Land.

- a. Position yourself to collect sample without taking any unnecessary risks.
- b. Holding the end of the rod opposite the dipper, lower dipper until it is completely below the surface (or to a specific depth) and collect grab sample.
- c. Transfer grab sample to appropriate sample container, continuing until you have collected the necessary number of samples for this location.
- d. Remove dipper from the rod and place dipper in a trash bag.
- e. Decontaminate the end of the rod, if necessary.
- f. Move to the next sampling location.
- g. Attach another dipper and repeat steps (a) through (e).

### 2. Sludge Sampling

Refer to Section XI (Sediments).

## D. REFERENCES

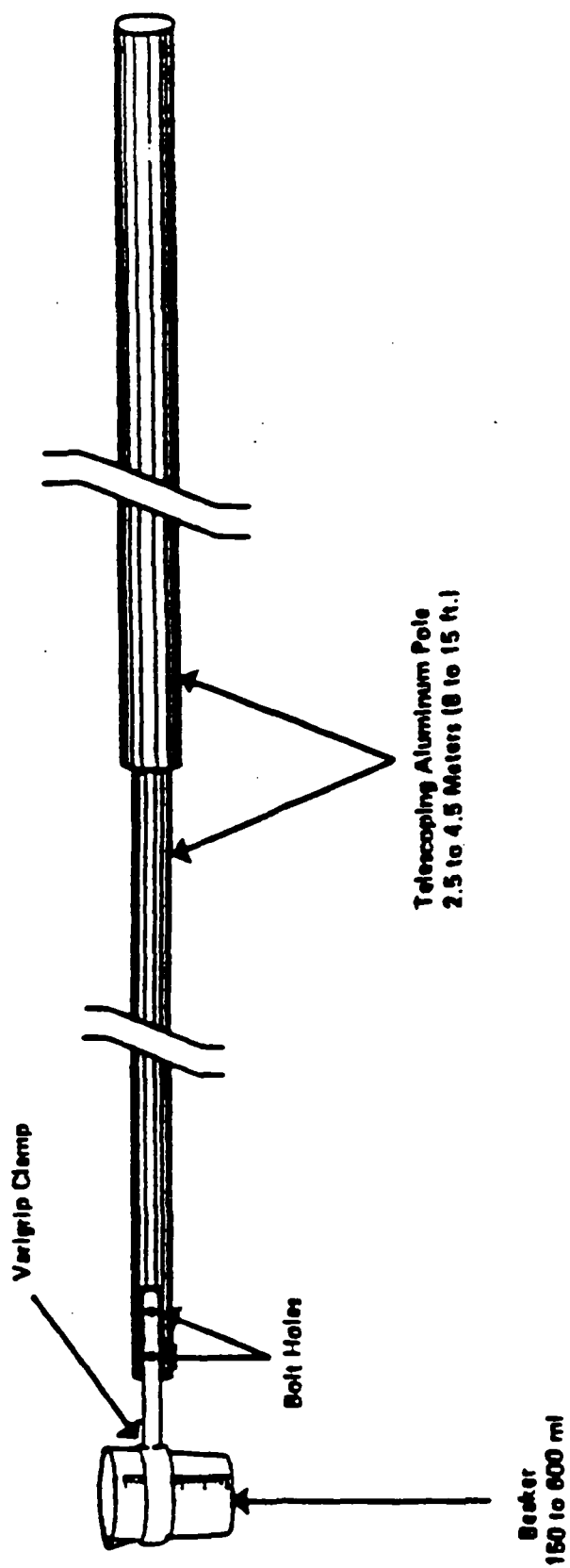
Illinois Environmental Protection Agency, Remedial Project Management Section.  
Methods & Procedures Manual for Activities Undertaken Under the Preliminary  
Assessment/Site Inspection Program, 1987.

U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response.  
Test Methods for Evaluating Solid Waste, Physical/Chemical Methods. SW-846,  
Volume II, Third Edition.

## E. FIGURE

4a -- Disposable Dip Sampler

**FIGURE 4a -- DISPOSABLE DIP SAMPLER**



# **SECTION V: WASTE PILE SAMPLING**

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## **SECTION V: WASTE PILE SAMPLING**

### **A. REMINDER CHECKLIST**

#### **1. Pre-Sampling Activities**

- \_\_\_ Establish purpose(s) of sampling.
- \_\_\_ Determine the extent of the sampling effort, the sampling methods to be employed, and which equipment and supplies are required.
- \_\_\_ Assess site hazards, and develop and/or review a safety plan.
- \_\_\_ Obtain necessary sampling and monitoring equipment; decontaminate or pre-clean the equipment, and ensure that it is in working order.
- \_\_\_ Bring enough clean water for rinsing, cleaning and cooling off.
- \_\_\_ Schedule lab time and order your bottles two weeks in advance.
- \_\_\_ If necessary, contact owner/operator prior to the trip to schedule the sampling event, to gain access to the site, to discuss the purpose of the sampling event, and to address any safety and security concerns at the site.
- \_\_\_ Be prepared to sample in extreme weather conditions, if applicable.
- \_\_\_ Schedule a meeting prior to the trip to ensure all sampling team members understand their role and responsibilities.
- \_\_\_ Identify local suppliers of sampling expendables (e.g., ice, plastic bags) and overnight delivery services (e.g., Federal Express), and recharge of SCBA air tanks (local fire Dept.).
- \_\_\_ Prepare your sample containers prior to sampling (label and organize).

#### **2. During Sampling Activities**

- \_\_\_ Document the sampling event. At a minimum, include weather conditions, date, time, sampler's name, photographs, any deviations from the original

sampling plan, and any problems encountered.

- Collect samples in order of volatilization. Special care must be taken when collecting VOC samples.
- If necessary, monitor the air in the area where sampling is taking place so that you can adjust your level of protection.
- Keep sample bottles in coolers properly preserved, sealed and maintain chain of custody.
- Never composite VOC samples.
- Wipe off outside of sample bottles prior to placement in cooler.
- Perform a general site survey prior to site entry in accordance with the site-specific health and safety plan.
- Use stakes or flagging to identify and mark all sampling locations. Specific site factors, including extent and nature of contaminants should be considered when selecting sample locations. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions.

### **3. Post Sampling Activities**

- Decontaminate all field equipment and PPE if appropriate, in accordance with the Health and Safety Plan. Return all reusable equipment to the IEPA warehouse or its place of origin.
- Classify all waste generated (i.e., IDW=cuttings, rinse waters, baggies, contaminated PPE) and dispose of properly.
- Keep samples cool; ship or drop off to appropriate laboratory, in accordance with BOL SOP for Sample Packaging and Shipping.
- Separate incompatible wastes so that they are not transported in the same cooler.
- Seal odorous wastes in a plastic bag and then in a cooler to avoid breathing vapors or odors during transportation.

- Transcribe field notes to memorandum form and submit to the Bureau File. Include photographs and a sketch of site with sampling locations clearly identified.

## **B. EQUIPMENT CHECKLIST**

See the attached sampling equipment checklist for a list of the equipment used for sampling waste piles.

## SAMPLING EQUIPMENT CHECKLIST

### PAPERWORK:

- ☐ IEPA Identification
- ☐ Safety Training Certification
- ☐ Lab Phone Numbers
- ☐ Site Map & Directions
- ☐ Chemical Analysis Forms
- ☐ Chain of Custody Forms
- ☐ Receipt for Samples (RCRA sites only)
- ☐ Field Log Forms or Field Log Book

### PROJECT MANAGER:

- ☐ Field Logbook
- ☐ Aluminum Case (for paperwork)
- ☐ Calculator
- ☐ Camera and Battery
- ☐ Pencils & Pens
- ☐ China Markers
- ☐ Compass
- ☐ Pocket Knife
- ☐ Emergency Raingear
- ☐ Paper Towels
- ☐ PPE Gloves ☐ L ☐ XL
- ☐ pH Paper
- ☐ Decon Spray Bottles:
  - ☐ Liquinox Solution
  - ☐ Deionized/Distilled Water

### GENERAL SAMPLING EQUIPMENT:

- ☐ Sample Bottles
- ☐ Extra Bottle Labels
- ☐ Waterproof Clear Tape
- ☐ Visqueen (pre-cut)
- ☐ Utility Knife or Pocket Knife
- ☐ Portable Table
- ☐ Garbage Bags
- ☐ Rain Canopy & Poles
- ☐ Nylon Rope
- ☐ Water Carriers
- ☐ Paper Towels
- ☐ Duct Tape
- ☐ Masking Tape
- ☐ Flashlights & Batteries
- ☐ Binoculars
- ☐ Aluminum Foil
- ☐ Shovel
- ☐ Trowel/Sampling Spoons
- ☐ Machete

### FOR DECON:

- ☐ Spray Bottles:
  - ☐ Liquinox Solution
  - ☐ Distilled/Deionized Water
- ☐ ½-Gallon Jugs:
  - ☐ HCL; dilute to 5 or 10%
  - ☐ Liquinox Solution
  - ☐ DI Water
- ☐ 5-Gallon Sprayers:
  - ☐ Liquinox Solution
  - ☐ Tap Water
  - ☐ Extra Gallons of DI Water
- ☐ Paper Towels
- ☐ Aluminum Foil
- ☐ Brushes
- ☐ Plastic Tubs
- ☐ 5-Gallon Plastic Buckets
- ☐ Garbage Bags

### FOR FIELD MEASUREMENTS:

- ☐ Passport
- ☐ PID
- ☐ FID
- ☐ pH/Temp/Millivolt Meter
- ☐ Battery; 9-volt
- ☐ pH Buffers; 4, 7, & 10
- ☐ Radiation Detector
- ☐ Draeger Pump, Tubes
- ☐ TVA

### PPE, SAFETY & SUPPORT:

- ☐ Cleaning & Cooling Water
- ☐ Drinking Water
- ☐ Gatorade
- ☐ Ice for Drinking Water
- ☐ Hand Soap/Goop
- ☐ First Aid Kit
- ☐ Insect/Tick Repellant
- ☐ Sunscreen
- ☐ Fire Extinguishers
- ☐ Walkie Talkies
- ☐ Full-Face Respirators
- ☐ Cartridges
- ☐ SCBAs
- ☐ Cylinders
- ☐ Field Chairs
- ☐ Disposable Booties
- ☐ Tyvek
- ☐ Saranex
- ☐ Raingear
- ☐ Cotton Coveralls

### SEALING & TRANSPORTATION:

- ☐ Coolers
- ☐ Blue Ice
- ☐ Dry Ice
- ☐ Regular Ice
- ☐ Large Liners for Coolers
- ☐ 1-Gallon Ziplock Bags
- ☐ Quart Ziplock Bags
- ☐ Large FDA Cooler Bags
- ☐ Evidence Tape
- ☐ Strapping Tape

### FOR WASTE PILES:

- ☐ Tape Measure
- ☐ Homogenization Bowl or Bucket
- ☐ Spatula
- ☐ Scoop
- ☐ Plastic or Stainless Steel Spoons
- ☐ Trowel
- ☐ Continuous Flight Screw Auger
- ☐ Bucket Auger
- ☐ Post Hole Auger
- ☐ Extension Rods
- ☐ Sampling Trier
- ☐ T-handle
- ☐ Thin Wall Tube Sampler
- ☐ Grain Sampler

## **C. PROCEDURES**

### **1. Sampling With Shovels and Scoops**

Collection of samples from surface portions of the pile can be accomplished with tools such as spades, shovels, and scoops. Surface material can be removed to the required depth with this equipment. Then, a stainless steel or plastic scoop can be used to collect the sample.

Accurate, representative samples can be collected with this procedure depending on the care and precision demonstrated by sample team members. Use of a flat, pointed mason trowel to cut a block of the desired material can be helpful when undisturbed profiles are required. A stainless steel scoop, lab spoon, or plastic spoon will suffice in most other applications. Care should be exercised to avoid the use of devices plated with chrome or other materials. Plating is particularly common with implements such as garden trowels.

Use the following procedure to collect surface samples:

- a. Carefully remove the top layer of material to the desired sample depth with a precleaned spade.
- b. Using a precleaned stainless steel scoop, plastic spoon, or trowel, remove and discard a thin layer of material from the area which came in contact with the spade.
- c. If volatile organic analysis is to be performed:
  1. Transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap tightly. Fill container as full as possible to minimize air space.
  2. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval.
  3. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly.

4. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

## **2. Sampling With Augers and Thin-Wall Tube Samplers**

This system consists of an auger, a series of extensions, a "T" handle, and a thin-wall tube sampler (Figure 5b). The auger is used to bore a hole to a desired sampling depth, and is then withdrawn. The sample may be collected directly from the auger. If a core sample is to be collected, the auger tip is then replaced with a thin-wall tube sampler. The system is then lowered down the borehole, and driven into the pile at the completion depth. The system is withdrawn and the core collected from the thin-wall tube sampler.

Several augers are available. These include: bucket, continuous flight (screw), and post hole augers. Bucket augers are better for direct sample recovery since they provide a large volume of sample in a short time. When continuous flight augers are used, the sample can be collected directly from the flights, which are usually at 5-foot intervals. The continuous flight augers are satisfactory for use when a composite of the complete waste pile column is desired. Post hole augers have limited utility for sample collection as they are designed to cut through fibrous, rooted, swampy areas.

Use the following procedure for collection of waste pile samples with the auger:

- a. Attach the auger bit to a drill rod extension, and attach the "T" handle to the drill rod.
- b. Clear the area to be sampled of any surface debris. It may be advisable to remove the first 3 to 6 inches of surface material for an area approximately 6 inches in radius around the drilling location.
- c. Begin augering, periodically removing and depositing accumulated materials onto a plastic sheet spread near the hole. This prevents accidental brushing of loose material back down the borehole when removing the auger or adding drill rods. It also facilitates refilling the hole, and avoids possible contamination of the surrounding area.
- d. After reaching the desired depth, slowly and carefully remove the auger from the boring. When sampling directly from the auger, collect sample after the auger is removed from boring and proceed to Step j.
- e. Remove auger tip from drill rods and replace with a precleaned thin-wall tube sampler. Install proper cutting tip.

- f. Carefully lower the tube sampler down the borehole. Gradually force the tube sampler into the pile. Care should be taken to avoid scraping the borehole sides. Avoid hammering the drill rods to facilitate coring as the vibrations may cause the boring walls to collapse.
- g. Remove the tube sampler, and unscrew the drill rods.
- h. Remove the cutting tip and the core from device.
- i. Discard the top of the core (approximately 1 inch), as this represents material collected before penetration of the layer of concern. Place the remaining core into the appropriate labeled sample container. Sample homogenization is not required.
- j. If volatile organic analysis is to be performed:
  - 1. Transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap tightly. Again, fill container as full as possible to minimize air space.
  - 2. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval.
  - 3. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly.
  - 4. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.
- k. If another sample is to be collected in the same hole, but at a greater depth, reattach the auger bit to the drill and assembly, and follow steps c through k, making sure to decontaminate the auger and tube sampler between samples.

### **3. Sampling With a Trier**

This system consists of a trier and a "T" handle. The auger is driven into the waste pile and used to extract a core sample from the appropriate depth (Figure 5c).

Use the following procedure to collect waste pile samples with a sampling trier:

- a. Insert the trier into the material to be sampled at a 0° to 45° angle from horizontal. This orientation minimizes spillage of the sample. Extraction of the samples might require tilting of the sample containers.
- b. Rotate the trier once or twice to cut a core of material.
- c. Slowly withdraw the trier, making sure the slot is facing upward.
- d. If volatile organic analysis is to be performed:
  1. Transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap tightly.
  2. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval.
  3. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are being collected, place samples from the other sampling intervals into the homogenization container and mix thoroughly.
  4. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

### **4. Sampling With a Grain Sampler**

The grain sampler is used for sampling powdered or granular wastes or materials in bags, fiber drums, sacks, similar containers or piles (Figure 5d). This sampler is most useful when the solids are no greater than 1/4" in diameter.

This sampler consists of two slotted telescoping brass or stainless steel tubes. The outer tube has a conical, pointed tip at one end that permits the sampler to



penetrate the material being sampled. The sampler is opened and closed by rotation of the inner tube. Grain samplers are generally 24" to 40" long by ½" to 1" in diameter and are commercially available at laboratory supply houses.

Use the following procedures to collect waste pile samples with a grain sampler:

- a. With the sampler in the closed position, insert it into the granular or powdered material or waste being sampled from a point near a top edge or corner, through the center, and to a point diagonally opposite the point of entry.
- b. Rotate the sampler inner tube into the open position.
- c. Wiggle the sampler a few times to allow material to enter the open slots.
- d. With the sampler in the closed position, withdraw it from the material being sampled.
- e. Place the sampler in a horizontal position with the slots facing upward.
- f. Rotate the outer tube and slide it away from the inner tube.
- g. If volatile organic analysis is to be performed:
  1. Transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap tightly.
  2. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval.
  3. Then either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly.
  4. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

## **D. REFERENCES**

Reproduced in part from OSWER Directive 9360.4-07, January 1991.

## **E. FIGURES**

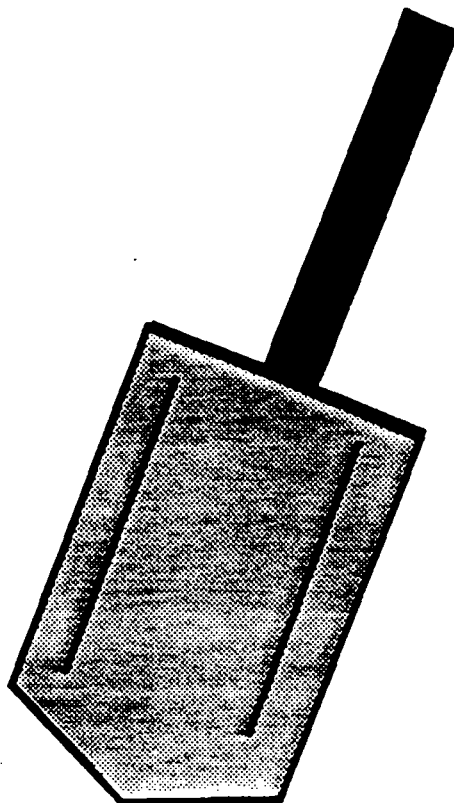
5a -- Scoops and Shovels

5b -- Sampling Augers

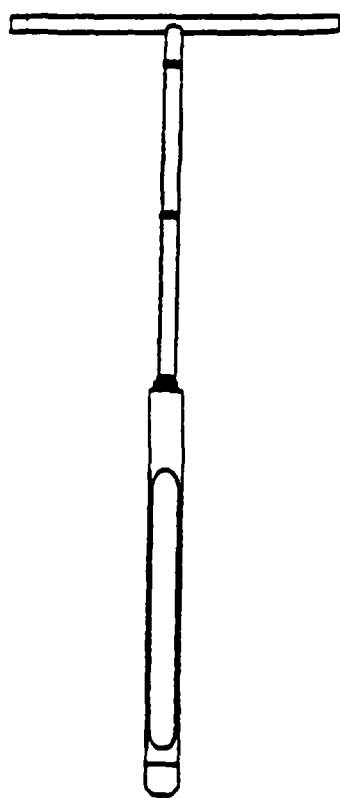
5c -- Sampling Trier

5d -- Grain Sampler

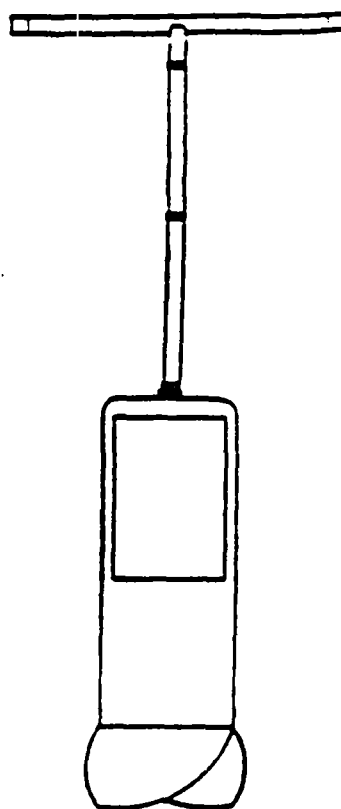
**FIGURE 5a – SCOOPS AND SHOVELS**



**FIGURE 5b – SAMPLING AUGERS**

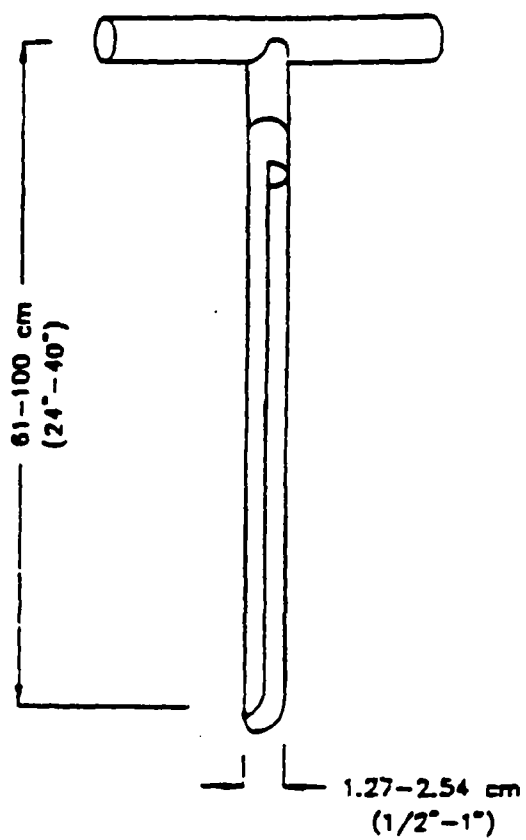


**TUBE  
AUGER**

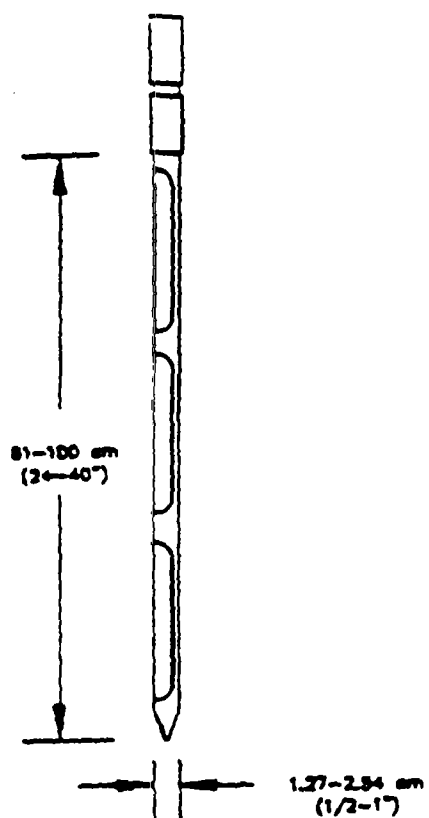


**BUCKET  
AUGER**

**FIGURE 5c – SAMPLING TRIER**



**FIGURE 5d - GRAIN SAMPLER**



# **SECTION VI: SOIL SAMPLING**

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# SECTION VI. SOIL SAMPLING

## PREFACE

Soil samples may be recovered using a variety of methods and equipment. These are dependent on the depth of the desired sample, the type of sample required (disturbed vs. undisturbed), and the soil type.

Surface soils may be sampled easily using a spade, trowel, and scoop. Near surface soil sampling may be performed using a hand auger, a power auger, drilling, or, if a test pit is required, a backhoe. The selection of the sampling devices should be based upon the cohesiveness of the soil and the chemical characterization or analytes of concern (e.g. VOCs or metals). The drilling or sampling methodology chosen should cause the least amount of disturbance to the subsurface materials. The introduction of foreign materials can change the physical, chemical and biological nature of the soils to be sampled.

The objective of subsurface sampling is to obtain representative samples of subsurface materials. The sample may be either composite or discrete, and either disturbed or undisturbed. The type of sample that is taken depends on the drilling technique and the purpose of the investigation. As the project manager, discuss the type of samples needed with the driller and all pertinent personnel to ensure that the objectives of the sampling episode are met. The sample handling procedures described here for surface soil sampling should be employed once a soil boring core is extracted from the ground. For more information on drill rig operations reference the "Drill Rig Unit Methods and Procedures Manual." Ms. Sherry Otto maintains a copy of this manual and she may be reached at 785-9384.

In some situations it might be best to drill two borings in close proximity; one to obtain soil samples for chemical analyses and the other for describing the physical characteristics of the soil. Additional soil sampling during an investigation, beyond that for chemical contaminants, may be required to determine the physical characteristics of particular soil strata. In Illinois, the classification of groundwater often includes evaluating physical characteristics of water bearing soils. Groundwater classification significantly impacts cleanup objectives for both soils and groundwater in our state. Reference administrative procedure #26 for guidance on what physical attributes in soil affect the classification of groundwater.

Remember to follow all health and safety guidelines when handling samples. Environmental sampling may be the closest contact one will have with hazardous materials.



## **A. REMINDER CHECKLISTS**

### **1. Pre-Sampling Activities**

- \_\_\_ Establish purpose(s) of sampling.
- \_\_\_ Assess site hazards, and develop and/or review site safety plan.
- \_\_\_ Develop and/or review sampling plan.
- \_\_\_ Obtain necessary sampling and monitoring equipment; decontaminate or preclean the equipment, and ensure that it is in working order.
- \_\_\_ Prepare your bottles in advance of sampling (label and organize).
- \_\_\_ Bring enough clean water for rinsing, cleaning and cooling off.
- \_\_\_ Identify and stake all sampling locations. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions. All staked locations must be utility-cleared 48 hours in advance through J.U.L.I.E. at 1-800-892-0123 or in Chicago at 312-744-7000. When using the drill rig make sure that the rig will be at least 100 feet away from any overhead power lines (OSHA 29 CFR 1910.180) or notify the power company to turn off the lines.
- \_\_\_ Be prepared to sample in extreme weather conditions, if applicable.
- \_\_\_ Schedule a meeting prior to the trip to ensure all sampling team members understand their roles and responsibilities.
- \_\_\_ If necessary, contact owner/operator prior to the trip to schedule the sampling event, to gain access to the site, to discuss the purpose of the sampling event, and to address any safety and security concerns at the site.
- \_\_\_ Identify local suppliers of sampling expendables (e.g. ice, plastic bags) overnight delivery services (e.g. Federal Express), and recharge of SCBA air tanks; contact nearest public water supply that is contaminant free for drilling/cleaning of drill rig equipment, if necessary.
- \_\_\_ Prepare sample containers prior to sampling (label and organize).

## 2. During Sampling Activities

- \_\_\_ Perform a general site survey prior to site entry.
- \_\_\_ Document the sampling event. At a minimum, include weather conditions, date, time, sampler's name, photographs (directions and distances), any deviations from the original sampling plan, and any problems encountered.
- \_\_\_ Monitor the air in the area where sampling is taking place so that you can adjust your level of protection. **Note: take special precautions around rotating augers. Never touch or reach behind a rotating auger. Make sure all sampling personnel know where the "kill switch" is on the drill rig.**
- \_\_\_ Always take background samples from the same soil types and from similar depths.
- \_\_\_ Collect samples in order of volatilization. Special care is taken when collecting VOC samples.
- \_\_\_ Never composite VOC samples.
- \_\_\_ Pack volatile samples to limit the amount of head space, but not too tightly; volatile contaminants may be squeezed out of the container.
- \_\_\_ Wipe off outside of sample bottles prior to placement in cooler.
- \_\_\_ Photograph sample container at sampling location.
- \_\_\_ Keep sample bottles properly preserved, sealed, in coolers on ice and maintain chain of custody.

## 3. Post-Sampling Activities

- \_\_\_ Decontaminate all field equipment, and PPE if appropriate, in accordance with the Health and Safety Plan. Clean or decontaminate all reusable equipment before returning to the IEPA warehouse or its place of origin.
- \_\_\_ Classify all waste generated (i.e. IDW = cuttings, rinse waters, baggies, contaminated PPE) and dispose of properly.
- \_\_\_ Keep samples cool; ship or drop off to appropriate laboratory, in accordance with the program specific standard operating procedure for

sample packaging and shipping.

- Separate incompatible wastes so that they are not transported in the same cooler.
- Seal odorous wastes in plastic bags in a cooler to avoid breathing vapors or odors during transportation.
- Transcribe field notes to memorandum form and submit to the Bureau File, include photographs and a sketch of site with sampling locations clearly identified.
- When using the drill rig, within 30 days a well construction/geological report should be submitted to the Illinois Department of Public Health.

## **B. EQUIPMENT CHECKLIST**

See the next page for a sampling equipment checklist for a list of the equipment used for sampling.

## SAMPLING EQUIPMENT CHECKLIST

### **PAPERWORK:**

- ☐ IEPA Identification
- ☐ Safety Training Certification
- ☐ Lab Phone Numbers
- ☐ Site Map & Directions
- ☐ Chemical Analysis Forms
- ☐ Chain of Custody Forms
- ☐ Receipt for Samples (RCRA sites only)
- ☐ Field Log Forms or Field Log Book

### **PROJECT MANAGER:**

- ☐ Field Logbook
- ☐ Aluminum Case (for paperwork)
- ☐ Calculator
- ☐ Camera (film/battery)
- ☐ Pencils & Pens (Waterproof)
- ☐ China Markers
- ☐ Compass
- ☐ Pocket Knife
- ☐ Emergency Raingear
- ☐ Paper Towels
- ☐ PPE Gloves ☐ L ☐ XL
- ☐ pH Paper
- ☐ Decon Spray Bottles:
  - ☐ Liquinox Solution
  - ☐ Deionized/Distilled Water

### **GENERAL SAMPLING EQUIPMENT:**

- ☐ Sample Bottles
- ☐ Extra Bottle Labels
- ☐ Waterproof Clear Tape
- ☐ Visqueen (pre-cut)
- ☐ Utility Knife or Pocket Knife
- ☐ Portable Table
- ☐ Garbage Bags
- ☐ Rain Canopy & Poles
- ☐ Nylon Rope
- ☐ Water Carriers
- ☐ Paper Towels
- ☐ Duct Tape
- ☐ Masking Tape
- ☐ Flashlights & Batteries
- ☐ Binoculars
- ☐ Aluminum Foil
- ☐ Shovel
- ☐ Trowel/Sampling Spoons
- ☐ Machete
- ☐ Tape Measure
- ☐ Photoboard

### **FOR DECON:**

- ☐ Spray Bottles:
  - ☐ Liquinox Solution
  - ☐ Distilled/Deionized Water
- ☐ 1/2-Gallon Jugs:
  - ☐ HCL; dilute to 5 or 10%
  - ☐ Liquinox Solution
  - ☐ DI Water
- ☐ 5-Gallon Sprayers:
  - ☐ Liquinox Solution
  - ☐ Tap Water
  - ☐ Extra Gallons of DI Water
- ☐ Paper Towels
- ☐ Aluminum Foil
- ☐ Brushes
- ☐ Plastic Tubs
- ☐ 5-Gallon Plastic Buckets
- ☐ Garbage Bags

### **FOR FIELD MEASUREMENTS:**

- ☐ Passport
- ☐ PID
- ☐ FID
- ☐ TVA
- ☐ pH/Temp/Millivolt Meter
  - ☐ Battery; 9-volt
- ☐ pH Buffers; 4, 7, & 10
- ☐ Radiation Detector
- ☐ Draeger Pump, Tubes

### **PPE, SAFETY & SUPPORT:**

- ☐ Cleaning & Cooling Water
- ☐ Drinking Water
- ☐ Gatorade
- ☐ Ice for Drinking Water
- ☐ Hand Soap/Goop
- ☐ First Aid Kit
- ☐ Insect/Tick Repellant
- ☐ Sunscreen
- ☐ Fire Extinguishers
- ☐ Walkie Talkies
- ☐ Full-Face Respirators
- ☐ Cartridges
- ☐ SCBAs
- ☐ Cylinders
- ☐ Field Chairs
- ☐ Disposable Booties
- ☐ Tyvek
- ☐ Saranex
- ☐ Raingear
- ☐ Cotton Coveralls
- ☐ Insulated Coveralls
- ☐ Steel-Toed/Shanked Boots
- ☐ Insulated Pack-Boots
- ☐ Hardhat/Face Shields
- ☐ Nitrile/Butyl Rubber/Neoprene Gloves
- ☐ Glove Liners
- ☐ Safety Glasses

### **SEALING & TRANSPORTATION**

- ☐ Coolers
- ☐ Blue Ice
- ☐ Dry Ice
- ☐ Regular Ice
- ☐ Large Liners for Coolers
- ☐ 1-Gallon Ziplock Bags
- ☐ Quart Ziplock Bags
- ☐ Large FDA Cooler Bags
- ☐ Evidence Tape
- ☐ Strapping Tape
- ☐ Vermiculite
- ☐ Tie Wraps (for coolers)

### **FOR SOIL:**

- ☐ Survey Stakes or Flags
- ☐ Stainless Steel Buckets,
  - ☐ Pans or Bowls
- ☐ Plastic Sheet for
  - ☐ Cuttings/Spoils
- ☐ Volatile Sampling Inserts
- ☐ Wax or Foil to Seal Inserts
- ☐ Tube Auger
- ☐ Extension Rods
- ☐ T-Handle
- ☐ Pick Hammer

## C. PROCEDURES

### 1. Soil Sampling by Hand

Collection of samples from surface soil (< 3 feet) can be accomplished with tools such as spades, shovels, and scoops. The surface material can be removed to the required depth with this equipment; then a stainless steel or plastic scoop can be used to collect the sample. This method can be used in most soil types but is limited to sampling near surface areas.

The use of a flat, pointed, mason trowel to cut a block of the desired soil can be helpful when undisturbed profiles are required. A stainless steel scoop, lab spoon, or plastic spoon will suffice in most applications. In freezing conditions a pick hammer may be used to break through frozen ground. Care should be exercised to avoid the use of devices plated with chrome or other materials. Plating is particularly common with garden implements such as potting trowels.

It is not recommended that VOC samples be collected at the surface, as these compounds probably have volatilized already; however, it may be acceptable to sample to determine the presence or absence of concentrations of volatile contaminants in the surface soil in spill situations where limited downward migration is expected. Volatile samples taken from a depth of 2 to 3 feet may more reliably represent contaminant conditions in a clay matrix.

- a. Collecting surface soil samples (< 3 feet):
  - i. Remove grass/turf cover.
  - ii. Carefully remove the top layer of soil to the desired sample depth with a precleaned spade or stainless steel scoop.
  - iii. Using a precleaned, stainless steel scoop, plastic spoon, or trowel, remove and discard a thin layer of soil from the area which came in contact with the shovel. Also remove as many roots as possible.
  - iv. Transfer sample into an appropriate sample container using a clean stainless steel or plastic lab spoon, or equivalent. If composite samples are to be collected, place the soil sample in a clean stainless steel or plastic bucket, tray or pan, and mix thoroughly to obtain a homogeneous sample representative of the entire sampling interval. Then, place soil sample into labeled containers. Try to collect a sample that has as few roots and pebbles as possible. It is very important to remember to use a clean, i.e. decontaminated, scoop, spoon, trowel, bucket, tray, pan etc. for each sample and

sampling interval. Use of thoroughly decontaminated equipment will eliminate the possibility of cross contaminating samples.

**Caution: Never composite VOC samples.**

The risk of losing volatile contaminants is great when exposing the sample to air for even a brief amount of time. If samples for volatile organic analysis will be collected, they need to be collected directly from the bottom of the hole (before mixing the sample if a non-volatile composite sample is to be collected), to minimize volatilization of contaminants. Quickly pack volatile samples into the sample containers to limit the amount of head space, but not too tightly. Volatile contaminants may be squeezed out of the sample and container if packed too tightly.

- v. Fill the sample jar fully to the top to reduce headspace. Check that the Teflon® liner, if required, is present in the cap. Secure the cap tightly. Wipe off the outside of the jar prior to placing in cooler.
  - vi. Fill in the hole and replace grass turf if necessary. If the surface is contaminated, fill the hole with granular bentonite to prevent the movement of contaminants into the subsurface.
  - vii. Collect QA/QC samples as specified in sampling plan or quality assurance plan.
  - viii. Decontaminate equipment between samples according to BOL's SOP for Equipment Decontamination (to be developed).
- b. Sampling at depth (3 to 10 feet) with hand augers

This system consists of a fully open or half open face bucket auger, a series of extensions, and a T-handle. The auger is used to bore a hole to a desired sampling depth, and is then withdrawn. The auger tip is then cleaned or replaced with a clean auger to prevent cross contamination, lowered down the borehole, and driven into the soil at the completion depth. The core is then withdrawn and the sample collected. The Agency also has posthole augers. Posthole augers have limited utility for sample collection as they are designed to cut through fibrous, rooted, swampy soil. Posthole augers are most acceptable for composite sampling.

Collect samples with a hand auger as follows:

- i. Attach the auger bit to a drill rod extension, and attach the T-

handle to the drill rod.

- ii. Clear the area to be sampled of any surface debris (e.g. twigs, rocks, litter). It may be advisable to remove the first 3 to 6 inches of surface soil for an area approximately 6 inches in radius around the drilling location. A pick hammer may be necessary to remove the upper layer in freezing conditions.
- iii. Begin auguring, periodically removing and depositing accumulated soils onto a plastic sheet spread near the hole. This prevents accidental brushing of loose material back down the borehole when removing the auger or adding drill rods. It also facilitates refilling the hole, and avoids possible contamination of the surrounding area.
- iv. After reaching the desired depth, slowly and carefully remove the auger from the boring. When sampling directly from the auger, collect sample after the auger is removed from boring as described in step "vii."
- v. Carefully lower the clean bucket auger (or tube sampler if soils allow) down the borehole. Continue boring with the bucket auger or gradually force the tube sampler into soil. Care should be taken to avoid scraping the borehole sides. Avoid hammering the drill rods to facilitate coring, as the vibrations may cause the boring walls to collapse.
- vi. Remove the auger from hole. Either unscrew the drill rods and from the auger and remove sample or remove soil core from the auger while rods are attached.
- vii. When a cohesive substrate is being sampled, discard the top of the core (approximately 1 inch), as this represents material collected before penetration of the layer in question. Place the remaining core directly into the sample container or into a clean compositing pan or bowl. Minimize possible volatilization of VOCs by limiting agitation, exposure to air, and headspace. If you are compositing, mix thoroughly to homogenize the sample(s) as much as possible.
- viii. Carefully and clearly label the container with the appropriate sample tag addressing all the sample packaging and shipping categories or parameters required by your program.
- ix. Secure the cap tightly onto the sample container. If required for

volatiles, ensure that a Teflon® liner is present in the cap. Wash off the sample container with deionized water. Place the sample bottle in a plastic bag, and put on ice to keep the sample at 4°C.

- x. Use a chain-of-custody form to document the types and numbers of soil samples collected and logged. Verify that the chain-of-custody form is correctly and completely filled out prior to shipping.
- xi. Record the time and date of sample collection, as well as a description of the sample and direction of any picture taken in the field logbook.
- xii. If another sample is to be collected in the same hole, but at a greater depth, reattach the decontaminated auger bit or a different, clean auger to the rods and redo steps iii. through xi. Make sure to decontaminate the auger or tube sampler between samples to avoid cross contamination of samples.
- xiii. Abandon the hole according to applicable regulations and guidance. Generally, shallow holes can simply be backfilled with the removed soil material.

## 2. Soil Sampling Using Power Tools

### a. Auger Sampling

- i. This method should **not** be used for VOC analysis.
- ii. Examine the soil with an organic vapor instrument and record the reading.
- iii. For noncohesive soils a sample can be collected from the auger cuttings. Cohesive soils may wrap around the auger and a sample can be collected from the auger. **NOTE: The augers must not be rotating and the drill rig should be in neutral. Make sure the drill rig operator knows what you are doing.**
- iv. Using a clean stainless steel or plastic trowel or scoop, collect a sufficient quantity of soil from the auger or soil cuttings.
- v. Transfer sample into an appropriate sample container with a clean stainless steel or plastic spoon, or equivalent. If composite samples are to be collected, place the soil sample into a clean stainless steel



or plastic bucket, tray or pan and mix thoroughly to obtain a homogeneous sample representative of the entire sampling interval. Then place the soil sample into the proper labeled containers. Try to collect a sample that has as few roots and pebbles as possible.

- vi. Transfer the sample container(s) to a chilled cooler.
- vii. Follow appropriate equipment decontamination and established IDW disposal procedures.
- viii. Backfill the bore hole with granular bentonite to prevent cross contamination within the subsurface strata.
- ix. Complete all necessary field documentation.

b. Split-Barrel (Tube) Sampling of Soils

- i. The drill rig operator should follow the American Society for Testing and Materials (ASTM) standard method for penetration test and split-barrel sampling of soils D 1586.
- ii. Examine the soil with an organic vapor instrument and record the reading.
- iii. Using a clean stainless steel or plastic trowel or knife, collect a sufficient quantity of soil and place it into the appropriate sample containers. If composite samples are collected, place the soil sample into a clean stainless steel or plastic bucket, tray or pan and mix thoroughly to obtain a homogeneous sample representative of the entire sampling interval. Then place the soil sample into the proper labeled containers.
- iv. When sampling for VOCs, a clean stainless steel tube(s) can be placed inside the split-barrel sampler. Follow Administrative Procedure #14 on Soil Volatile Sampling Procedures.
- v. Transfer the sample container(s) to a chilled cooler.
- vi. Follow appropriate equipment decontamination and established IDW disposal procedures.
- vii. Continue drilling and sampling as described in the sampling plan. Upon completion of boring, backfill the hole with granular bentonite to prevent cross contamination within the subsurface

strata.

viii. Complete all necessary field documentation.

c. 5 Ft. Continuous Split Tube Sampling of Soils

i. The drill rig operator should follow any applicable American Society for Testing and Materials (ASTM) standards for use of this sampling device.

ii. Examine the soil with an organic vapor instrument and record the reading.

iii. Using a clean stainless steel or plastic trowel or knife, collect a sufficient quantity of soil and place it into the appropriate sample containers. If composite samples are collected, place the soil sample into a clean stainless steel or plastic bucket, tray or pan and mix thoroughly to obtain a homogeneous sample representative of the entire sampling interval. Then place the soil sample into the proper labeled containers.

iv. When sampling for VOCs, a clean stainless steel tube(s) can be placed inside the split tube. Follow Administrative Procedure #14 for Soil Volatile Sampling Procedures.

v. Transfer the sample container(s) to a chilled cooler.

vi. Follow appropriate equipment decontamination and established IDW disposal procedures.

vii. Continue drilling and sampling as described in the sampling plan. Upon completion of the boring, backfill the hole with granular bentonite to prevent cross contamination within the subsurface strata.

viii. Complete all necessary field documentation.

d. Thin-Walled (Shelby) Tube Sampling of Soils

i. The drill rig operator should follow the American Society for Testing and Materials (ASTM) standard practice for thin-walled tube sampling of soils D1587.

ii. This method is not recommended for loose noncohesive soils such

as sands and gravels.

- iii. Examine the ends of the sample tube with an organic vapor instrument and record the reading.
- iv. Add additional clay to the ends of the sample, if necessary, to eliminate head space and cover both ends of the sample tube with aluminum foil and a plastic cap.
- v. Place the sample tube into a chilled cooler.
- vi. Follow appropriate equipment decontamination and established IDW disposal procedures.
- vii. Continue drilling and sampling as described in the sampling plan. Upon completion of boring, backfill the hole with granular bentonite to prevent cross contamination within the subsurface strata.
- viii. Complete all necessary field documentation.

## **D. REFERENCES**

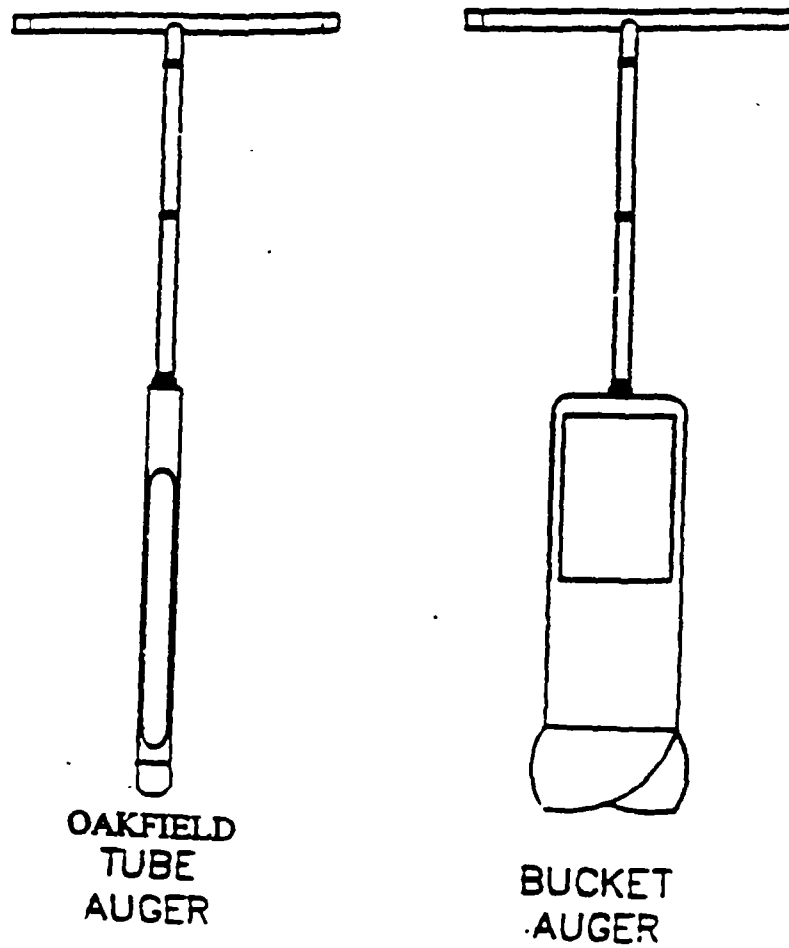
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## **E. FIGURES**

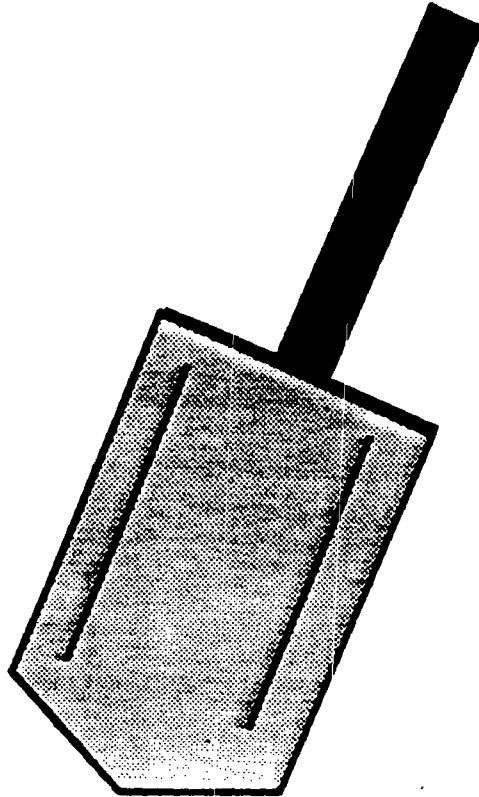
6a -- Trowel (Scoop)

6b -- Tube and Bucket Augers

**FIGURE 6b – TUBE and BUCKET AUGERS**



**FIGURE 6a – TROWEL (SCOOP)**



# **SECTION VII. GROUNDWATER SAMPLING**

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## SECTION VII. GROUNDWATER SAMPLING

### A. REMINDER CHECKLIST

#### 1. Pre-Sampling Activities

- Assess site hazards, and develop and/or review a site safety plan.
- Develop and/or review sampling plan.
- Establish purpose(s) of sampling.
- Obtain necessary sampling and monitoring equipment; decontaminate or pre-clean the equipment, and ensure that it is in working order.
- Bring enough clean water for rinsing, cleaning and cooling off.
- Schedule lab time and order your lab-prepared bottles 2 weeks in advance.
- Be prepared to sample in extreme weather conditions, if applicable.
- Schedule a meeting prior to the trip to ensure all sampling team members understand their role and responsibilities.
- If necessary, contact owner/operator (o/o) prior to the trip to schedule the sampling event, to gain access to the site (and monitor wells), to discuss the purpose of the sampling event, to address any safety and security concerns at the site, and to coordinate split samples if o/o requests.
- Identify local suppliers of sampling expendables (e.g., ice, plastic bags) and overnight delivery services (e.g., Federal Express), and recharge of SCBA air tanks (local Fire Dept.).
- Review Site geology, hydrogeology, monitor well construction, potential contaminants and contaminant behavior.
- Determine what QA/QC samples are necessary for the sampling objectives.
- Determine if any private drinking water wells will be sampled in conjunction with the monitor well sampling. Contact well owners in advance to schedule appointments.

- Prepare your sample containers prior to sampling (label and organize).

## **2. During Sampling Activities**

- Document the sampling event. At a minimum, include weather conditions, date, time, samplers' name, photographs, any deviations from the original sampling plan, and any problems encountered.
- Collect samples in decreasing order of volatility. Special care must be taken when collecting VOC samples (i.e., no headspace).
- If necessary, monitor the air in the area where sampling is taking place and near the headspace of the monitoring well to determine your level of protection.
- Keep samples properly preserved, sealed, cooled, and maintain chain of custody.
- Never composite VOC samples.
- Wipe off outside of sample bottles prior to placement in cooler.
- Package samples to prevent breakage and contamination from blue ice during transportation.

## **3. Post-Sampling Activities:**

- Decontaminate all field equipment and PPE if applicable, in accordance with the Health and Safety Plan. Return all reusable equipment to the IEPA warehouse or its place of origin.
- Classify all waste generated (e.g., Investigation derived waste or IDW = cuttings, rinse waters, baggies, contaminated PPE) and dispose of properly.
- Keep samples cool; ship or drop off to appropriate laboratory.
- Separate incompatible wastes so that they are not transported in the same cooler.
- Seal odorous wastes in a cooler to avoid breathing vapors or odors during transportation.

## **B. EQUIPMENT CHECKLIST**

See checklist below for appropriate sampling equipment.

## SAMPLING EQUIPMENT CHECKLIST

### PROJECT MANAGER:

- ☐ IEPA Identification
- ☐ Safety Training Certification
- ☐ Lab Phone Numbers
- ☐ Site Map & Directions
- ☐ Chain of Custody Forms
- ☐ Field Logbook
- ☐ Aluminum Case (for paperwork)
- ☐ Calculator
- ☐ Camera & Battery
- ☐ Pencils & Pens
- ☐ China Markers
- ☐ Compass
- ☐ Pocket Knife
- ☐ Emergency Raingear
- ☐ PPE Gloves

### PPE, SAFETY & SUPPORT:

- ☐ PPE gloves: Nitrile, latex, Butyl Rubber, or Neoprene
- ☐ Cleaning & Cooling Water
- ☐ Hand soap
- ☐ Drinking Water
- ☐ Gatorade
- ☐ Field Chairs
- ☐ Insect/Tick Repellent
- ☐ Sunscreen
- ☐ Raingear
- ☐ First Aid Kit
- ☐ Disposable Booties
- ☐ Fire Extinguishers
- ☐ Walkie Talkies
- ☐ Full-Face Respirators
- ☐ Cartridges
- ☐ SCBAs
- ☐ Cylinders
- ☐ Tyvek
- ☐ Saranex
- ☐ Cotton Coveralls
- ☐ Insulated Coveralls
- ☐ Steel-Toed/Shanked Boots
- ☐ Insulated Pack-Boots
- ☐ Hardhat/Face Shields
- ☐ Glove Liners

### FOR DECON:

#### Hand Spray Bottles:

- ☐ Liquinox Solution
- ☐ Distilled/Deionized Water
- ☐ HCL: dilute to 5 or 10%

#### 5-Gallon Sprayers:

- ☐ Liquinox Solution
- ☐ Tap Water
- ☐ Extra Gallons of DI Water
- ☐ Aluminum Foil
- ☐ Brushes
- ☐ Plastic Tubs
- ☐ Garbage Bags

### FOR FIELD SCREENING:

- ☐ Passport
- ☐ PID
- ☐ FID
- ☐ TVA
- ☐ CGI
- ☐ DL101
- ☐ Radiation Detector
- ☐ Draeger Pump, Tubes

### PURGING:

- ☐ KEYS TO WELLS
- ☐ Boltcutters, screwdriver,
- ☐ Vice grip
- ☐ Replacement Lock
- ☐ Water level indicator
- ☐ 3 AA batteries
- ☐ Paper towels
- ☐ Machete
- ☐ Visqueen (pre-cut)
- ☐ Utility knife
- ☐ Garbage bags
- ☐ Purge pump & battery
- ☐ Bailers
- ☐ Nylon Cordage
- ☐ 5-gal. Plastic purge buckets
- ☐ Stainless steel Weights
- ☐ (For unweighted PE bailers)
- ☐ Backpack frame
- ☐ Fishing gear:
  - ☐ Treble hooks & weights
  - ☐ Fishing line
- ☐ Flashlight & batteries
- ☐ Fluorescent flagging

### SAMPLING:

- ☐ Sample bottles
- ☐ Extra bottle labels
- ☐ Clear waterproof tape
- ☐ Portable Table
- ☐ pH paper
- ☐ pH,SC/Temp meter & 9-volt battery

### FILTERING:

- ☐ Peristaltic pump (charge battery)
- ☐ Silicone tubing
- ☐ Disposable filter cartridges

### SEALING & TRANSPORTATION:

- ☐ Coolers
- ☐ Blue Ice
- ☐ Dry Ice
- ☐ Regular Ice
- ☐ Large Food-grade baggies
- ☐ Quart Ziplock Bags
- ☐ Bubble wrap
- ☐ Evidence Tape
- ☐ USD Form

### OTHER

#### GENERAL SAMPLING EQUIPMENT:

- ☐ Rain Canopy & Poles
- ☐ Aluminum Foil
- ☐ Binoculars
- ☐ Shovel
- ☐ Trowel/Sampling Spoons

## C. PROCEDURES

### 1. Field QA/QC

#### a. Prevention of Cross-Contamination

1. Clean protective gloves (e.g., nitrile, latex, vinyl, neoprene, or other chemical resistant gloves) will be worn when working with the water level indicator, bailers, pump, or any other equipment that comes into contact with groundwater. The gloves serve to prevent cross-contamination between wells and also to protect the sampler. Gloves will be discarded after each monitor well and also if they become visibly contaminated or damaged during sampling.
2. Purging and sampling equipment that will be used in the monitor wells should never be placed directly on the ground. Plastic sheeting ("Visqueen") should be placed on the ground near the monitor well to provide a clean working area to place equipment and instruments and to prevent the suspension (if using a bailer) from accidentally touching the ground. This plastic sheeting is not for the sampling crew to step on. Bailer line should be kept off of the ground/Visqueen by using an electric cord reel or looping the line around the thumbs as it is pulled out of the well. All equipment should be kept in its cover or container until it is time to be used. However, once used, it should not be placed back into its container or case until decontaminated.

#### b. QA/QC Samples

1. All QC measures should be performed for at least the most sensitive chemical constituents for each sampling date. These samples are collected, preserved and submitted for analyses as any other sample, for selected parameters. Analyte-free distilled/deionized (DI, hereafter), water or Nanopure water obtained from the organic lab must be used for field blanks. Background samples and VOC lab trip blanks are mandatory for every sampling trip unless there is no background well to sample or VOC samples are not being collected. Other appropriate QA/QC samples should be collected if needed. This must be coordinated prior to the site visit.
2. The appropriate paperwork and chain of custody forms must be utilized for QA/QC samples.

3. Background Samples (Mandatory)

A background sample should be collected from a monitoring well that is upgradient from the source of contamination that is the target of the investigation. Sometimes the well that has been designated as upgradient is not truly upgradient and sometimes this is not known until a review of the analytical results or field measurements has been conducted. The background sample should be collected from the same aquifer or zone being monitored by the downgradient monitoring wells.

4. Lab Trip Blanks (Mandatory)

Trip blanks are used as a control sample to determine potential VOC contamination from the containers themselves or the atmosphere during sample shipment and storage. The IEPA lab will provide VOC trip blanks with sufficient notice. They will accompany the sample bottles and samples at all times until they are delivered to the lab. Trip blanks are not to be opened in the field. One set of VOC trip blanks (two 40ml vials) will be submitted with samples each day that samples are collected (USEPA, 1992) and for every 10 samples. For example, if 11 VOC samples are collected in one day, two sets of voc trip blanks should be submitted to the lab. Label the trip blanks with the date they were used if turning in more than one days worth of trip blanks.

5. Field Duplicate for Matrix Spike (Mandatory if using the 80-oz amber semi-volatile bottle). This is a semi-volatile sample collected simultaneously with the primary sample at the upgradient well or the well that is expected to be the least contaminated. These are to be collected if using the 80-oz amber glass bottle for semi-volatile analysis. If using the 1 gallon amber glass bottle, there is sufficient sample to run the matrix spike and an additional bottle need not be filled.

6. Field blanks (not mandatory, site-specific):

A. Field Equipment Blanks (also referred to as method blanks, rinsate blanks)

These are samples that are collected to verify the adequacy of decontamination efforts. The project manager should decide whether these blanks are needed. Whenever non-dedicated sampling equipment is used, equipment/field blanks should be collected. An equipment/field blanks is

obtained by passing analyte-free, DI water through a cleaned sampling apparatus (pump, bailer, filtration equipment, etc.) And collecting it in a clean sampling bottle. This blank is used to assess the effectiveness of the contamination procedures implemented between sampling locations. Ideally, equipment blanks should be collected after sampling the well(s) that historically show(s) highest levels of contamination. They should be collected at a frequency of one blank per 10 samples (Ohio EPA, 1995).

#### B. Field (air) Blank

To assess the potential contribution of airborne contaminants present in ambient air to groundwater samples being collected. Use an empty preserved VOC bottle and pour lab prepared analyte-free DI or Nanopure water into it and submit like any other sample.

#### c. Calibration of Equipment

Personnel should read the instructions prior to using any of the instruments.

The pH, specific conductance or millivolt, temperature meters will be calibrated in the field once per day in accordance with manufacturer guidelines which are to be kept with the equipment. This will be documented in the field notes. The meters(s) should be recalibrated if an apparent erroneous reading is obtained. If the meter cannot be recalibrated to meet the manufacturer's accuracy specifications, repair may be necessary.

The direct reading monitoring equipment (H-Nu, DL101, TVA, Passport, etc.) will also be calibrated according to manufacturer's specifications and this will be documented.

## 2. Approaching the Well

If driving a vehicle to the well, the vehicle must be turned off and the exhaust vapors allowed to dissipate before uncapping the well.

- a. Open protective outer casing of the well while standing crosswind or upwind from the well. The area around the headspace of the well will be monitored for organic vapors. Depending on the site-specific factors involved, one or more of the following instruments may be used: DL101, PID, CGI, OVA, TVA, Passport personal monitor. The project manager

must decide which instruments to use prior to the sampling event. The instruments must be calibrated in accordance with manufacturer's instructions.

- b. After taking the reading of the air around the outer casing, remove the well cap. Place the instrument probe near the opening of the well and observe the response of the instrument. The response will be observed for approximately one to two minutes or until the reading stabilizes.
- c. The type of response will be recorded, as to whether it was immediate, gradual, or none. Record the units or percent (%) reading. If no reading above background is recorded then proceed with the next activities. If there is a reading encountered above background, this reading will be taken into consideration when determining the level of respiratory protection required. The level of protection to be used while approaching the well should be determined prior to the sampling inspection, especially in the case of a leachate monitor well, which may have landfill gas emanating from it.

### **3. Inspecting the Well**

Each well will be visually inspected and the physical integrity ascertained by actually touching the inner casing to see if it moves (while wearing protective gloves). These observations will be documented. Factors to be verified in the inspection of the well are outlined on the attached, monitor well field inspection checklist, (optional), included as Attachment 2. The condition of each well should be documented with a photograph.

### **4. Static Water Level & Total Depth Measurements**

- a. Static water level measurements in all wells are to be taken within the shortest possible time of each other, and prior to purging the wells.
- b. Measurements are taken by starting at the least contaminated well and proceeding in order of increasing contamination. If no contamination has been detected in the past, or this information is not available, measure the upgradient wells first.
- c. If the wells have vented caps (the cap or inner casing has been drilled or notched, or the cap fits loosely enough that the air column in the well is in communication with the atmosphere), the water level measurements may be made as soon as the headspace has been monitored for organic vapors.



If the wells caps are not vented, the water level must be allowed to stabilize to obtain accurate readings after removal of the cap. The time



span required for the water level to stabilize could range from a few minutes to a few days, depending on the geologic material the well is screened in. ASTM Standard D4750 describes how to determine a stabilized liquid level. If water level measurements will be used for collecting groundwater gradients and flow direction, the most accurate readings possible must be collected. For purposes of calculating well purge volume, allow the wells to stabilize 5 minutes.

- d. If a dedicated bailer is being stored in the well (you should ask owner/operator about this prior to the site visit), you must do one of two things, depending on whether the bailer is stored above the water column or below. If the bailer is stored above the water column, remove the bailer and take your water level measurement. If the bailer is being stored below the water column, try to collect the static water level measurement prior to removal of the bailer. If this cannot be done, remove the bailer, let the water level stabilize, and take the water level measurement.
- e. Water level measurements are taken with an electronic sounder/tape. Measurements are to be made to the nearest hundredth (0.01) of a foot following these steps:
  - 1. Set the sensitivity according to manufacturer's specifications (high for clean water, low for highly contaminated water or leachate).
  - 2. Prior to inserting the probe of the water level indicator, rinse it with distilled water.
  - 3. While wearing protective gloves, slowly lower the probe in the well until the buzzer sounds.
  - 4. Raise the probe until the buzzer ceases.
  - 5. Slowly lower the probe until contact is just made. Repeat this until a confident reading is obtained (measure it at least three times).
  - 6. Holding the probe cable at the side of the inner casing, which serves as a reference point for measurements, note the point on the cable adjacent to the top of the inner casing.
  - 7. Record the water level measurement.

- \* The electric water level indicator will not respond to an oil layer floating on the water. Thus, the liquid level determined will be different than would be determined by a steel tape or an interface probe. The difference depends on how much oil is floating on the water (ASTM D4750).
- 8. In clean wells or wells with only dissolved contamination, measure the total depth of the well with the water level indicator. Use a graduated, weighted line or the electric water level meter with the sensitivity turned off. Lower the probe into the well. With the probe just touching the bottom of the well, measure the depth using the same procedure as for static water level measurements and record the measurement. This method of measurement is not accurate to the 0.01 foot. This measurement may indicate if siltation has occurred. However, keep in mind that the water level indicator is not intended to be an accurate way of measuring total depth.
- ☛ For highly contaminated wells, or leachate wells, **DO NOT LOWER THE WATER LEVEL PROBE BELOW THE LIQUID LEVEL.** Use a reusable stainless steel weight tied to a disposable suspension line, such as nylon cord, to detect the bottom of the well.
  - A. Slowly lower the weight into the well until the bottom is detected.
  - B. With the line taut, mark it against the reference point (top of inner casing) or grasp the line at that point and pull the line out of the hole and mark it where you are holding it. Mark it with a China marker or other type of marker (this part of the line never touches the groundwater).
  - C. Recover the line and weight from the well and accurately measure the length of line below the mark.
  - D. Discard the line and thoroughly clean the weight before reuse.
- 9. Thoroughly clean the probe with Liquinox and DI water as the line is being reeled out of the well.
- 10. Change protective gloves between wells.

## 5. Calculation of Water Volume in Casing

- a. To calculate the volume of water in the well casing, you need to know:
- Inside well casing diameter.
  - Total depth of well measured from a specified point, usually marked at the top of the inner casing.
  - Static water level depth measured from the same specified point.
  - Linear feet of water in the well (total depth - static water level).
- b. Using the table on the following page, calculate the static volume of water in the well using the following formula:

$$\text{Casing volume} = \text{Linear feet of water in the well (X)} \quad \underline{\text{Gallons of water per foot of depth}}$$

### Example:

Inner well casing diameter = 4 inches

Conversion factor for a 4-inch well (from table): 0.653 g/ft.


Static water level depth = 25 feet

Total depth of well = 40 feet

Linear feet of water in the well (40' - 25') = 15 feet

$$\text{Casing volume} = 15 \text{ feet (X)} \quad 0.653 \quad \underline{\text{gallons}} \\ \text{ft.}$$

$$\text{Casing volume} = 9.8 \text{ gallons}$$

 The volume of water determined through this calculation is considered one well (casing) volume. A well volume is the water that is contained within the inner casing of the well.

This well volume will be needed in the next section entitled "Purging the Well". The volume of water purged from the well must be recorded.

Also included on the next page is a "quick glance" table of gallons of water in a 2-inch well based on the linear feet of the water column (total depth minus static water

level depth).

**Conversion Factors to Calculate  
Well Casing Volume (gallons)**

Diameter of Casing or Hole (Inches)	Conversion Factor (Gallons per Foot)
1	0.041
1.5	0.092
2	<b>0.163*</b>
2.5	0.255
3	0.367
3.5	0.500
4	<b>0.653</b>
4.5	0.826
5	1.020
5.5	1.234
6	1.469
7	2.000
8	2.611
9	3.305
10	4.080
11	4.937
12	5.875
14	8.000
16	10.44
18	13.22
20	16.32
22	19.75
24	23.5
26	27.58
28	32.00
30	36.72
32	41.78
34	47.16
36	52.88

\*Linear ft. of water in the well X .163 (2-in. well)  
= Gallons of water in the well (One casing volume)

**Gallons of Water in a  
2-inch Diameter Well**

Linear Feet of Water Column	Volume of Water (Gallons)
0.5'	0.08
1.0'	0.163
1.5'	0.245
2.0'	0.326
2.5'	0.408
3.0'	0.489
3.5'	0.571
4.0'	0.652
4.5'	0.734
5.0'	0.815
5.5'	0.897
6.0'	0.978
<b>6.13'***</b>	<b>1.0</b>
6.5'	1.06
7.0'	1.14
7.5'	1.22
8.0'	1.30
8.5'	1.39
9.0'	1.47
9.5'	1.55
10.0'	1.63
10.5'	1.71
11.0'	1.79
11.5'	1.87
12.0'	1.96
12.5'	2.04
13.0'	2.12
13.5'	2.20
14.0'	2.28

\*\*\*Linear feet of water column = 6.13' (2-in well) = Gallons of water in the well (One well volume).

## 6. Purging

### a. General Procedures for All Monitor Wells

Purging is necessary because a ground-water sample must be representative of formation water. Water that has been standing in a well is typically not representative of formation water because water in the well above the well screen is not free to interact with formation water, is in contact with well construction materials (casing) for extended periods of time, is in direct contact with the atmosphere, and is subject to different chemical equilibria. Rust and scale from the monitoring well can interfere with lab analysis. A field study by Barcelona and Helfrich (1986) concluded that purging of standing water from the well was the dominant factor affecting precision of sampling results (Nielsen et al, 1991). Robin and Gillham (1987) showed that ground water moves through the screened portion of a well with little interaction or mixing with stagnant water in the overlying well casing. Similar studies by Powell and Puls (1993) supported this observation. Water in the screened area and sandpack is free to interact with the formation water, (Herzog et al. 1988; Nielsen, 1995).

A bailer or pump may be used to purge the well of stagnant water (water in the casing above the screened zone). These procedures do not dictate what type of equipment to use for purging and sampling. That decision should be made ahead of time by the project manager. Figures 7.1, 7.2, and 7.3 provide examples of some purging equipment.

1. Purge 3 to 5 well volumes from the well. In low recharge wells, purge down to a few inches below the top of the screen and commence sampling, (Nielsen, 1995). Dewatering the screen and the gravel pack should be avoided to minimize aeration/oxidation effects on water chemistry, and to minimize turbulence and turbidity of the sample, (Barcelona, 1985b; Kaminski, 1994; Nielsen, 1995; USEPA, 1992, pg. 7-8; USEPA, 1993, pg. B-5). The depth of the depth of the bailer in relation to the depth of the screen will need to be monitored. This is accomplished by calculating the depth of the screen from the top of the casing and tying a knot in the bailer cord to represent that depth (taking into account the length of the bailer). If depth to top of the screen is not known, make an estimation. Sampling for VOCs may commence immediately after the water level is lowered down to the screen area. The water level may be lowered below the top of the screen after VOCs are collected.

- ✓ It is impossible to not allow the water level in a water table well (a well screened across the water table) to fall below the top of the screen because the static water level is already below the top of the screen prior to purging, if screened properly. It is recommended that these wells be purged a minimal amount, such as one well volume, since there is no stagnant water column above the well screen.
- 2. Purge from the top of the static water level, so that mixing of the water in the screened zone with the overlying stagnant zone is kept to a minimum. Lower the purging device down the well as the water level drops, stopping just below the top of the screen.
- 3. The rate at which wells are purged of stagnant water should be kept to a minimum and should not exceed the rate at which the well was originally developed, if this is known. This is more of a concern when purging high yield wells with a pump.
- 4. Frequently, facilities have dedicated bailers and line that are left in the well. It should be decided ahead of time what steps will be taken if dedicated equipment is found in the well. It is not always advisable to use this dedicated equipment, depending on its condition. Frequently, disposable bailers are left in the well and re-used by facilities. This is not what they were intended for and are sometimes very dirty. If these are found in the wells, do not re-use them.
- 5. Plastic sheeting should be placed around the well to lay equipment on. Care should be taken not to step on plastic sheeting with dirty boots. Contact between the plastic sheeting and the bailer and suspension line should be kept to a minimum.
- 6. Great care must be taken when setting equipment around a monitoring well. Electronic equipment is very sensitive to humidity and moisture. Some equipment, such as the pH meter, will be ruined if one drop of water lands on it in the wrong spot. Cut the plastic sheeting large enough to be able to set equipment a sufficient distance from the well so that splashing will not affect it.
- 7. Where dedicated equipment is not used, purging should commence from the least contaminated well to the most contaminated well, whenever possible. Sometimes return trips will be needed to collect the entire sample because recharge is so slow in certain wells. Steps to protect against cross contaminations should always be practiced.

8. Deposit purge water into containers of known volume, such as 5-gallon buckets, in order to measure how much water has been purged. Record this for each well. Disposition of the purge water will be determined on a site-specific basis.
9. If using a pump or non-dedicated or non-disposable bailer, decontaminate them between wells. For decontamination guidelines refer to ASTM, 1992 and USEPA, 1992.

Note: There is sometimes a fine line between very low yield wells and dry wells. If the well continuously does not yield enough water to collect a full sample within 24 hours, this well could be considered inadequate or "dry". This should be noted and discussed with the project manager and/or permit reviewer. Most facility permits state that if a monitor well is consistently dry, then the well needs to be replaced. Document the beginning water level and observe the recharge capabilities of each well.

b. Purging with Bailers

1. Always purge from the top of the static water level when using a bailer.
2. The bailer must be lowered and pulled out as slowly as possible. It should be lowered slowly to prevent potential redevelopment and to minimize disturbance and aeration of the water column. It should be submerged only to a depth necessary for fill (during purging) and should be removed in a manner that causes as little agitation as possible. A bailer and cable should never come in contact with the ground (Ohio EPA, 1995, pg. 10-17; USEPA, 1992 pg. 7-19).
3. Do not "milk" the well by repeatedly and swiftly pulling the bailer up through the water column. This does not make the water enter the well any faster. It only serves to stir up sediments, yield a turbid sample, and possibly overdevelop the well.
4. Tie the suspension cord to the bailer with a very secure knot. Tie the end of the suspension line around the wrist for added protection. Refer to the discussion of "Lost Bailers" at the end of this section for retrieval procedures.

5. If it is necessary to temporarily leave the well during purging or sampling, store the bailer above the water level or above the point to which the water level is expected to rise, keeping the suspension line clean.

To accomplish this, follow these steps:

- a. Cover the lockplate of the protective casing with a clean paper towel or latex glove. Wrap the bailer's suspension line securely around it several times, so the bailer will not fall down the well.
- b. Place the rest of the line in a plastic bag (food-grade) for protection. Tie off the top of the bag or use the ziplock feature and place it inside the protective casing.
- c. Place the lid back on the well loosely. If the well is going to be left unattended for a short while, re-lock the well.

There are other ways to accomplish this, but the main idea is not to let the bailer sink down through the column of water and to keep the bailer and the line clean and off of the ground. If the well has no protective casing, the bailer and line may be stored in a clean 5-gallon bucket until it is used for sampling.

c. Purging with Pumps

1. Slowly pump stagnant water from the top of the water column and lower pump down as water level drops. Pumping rates during purging should be kept at a minimum. This will vary depending on the type of pump used. Excessive rates may result in the introduction of groundwater from zones above or below the well screen, which could dilute or increase contaminant concentration of samples (Ohio EPA, 1995). Purging may cease when 3-5 well volumes have been removed or the water level is just below the top of the screened interval.
2. For low yield wells (wells that would go dry with a bailer, if allowed) placement of the pump intake near the top of the screen for purging is adequate, if all of the stagnant water is removed above the pump.



3. Decontaminate any non-disposable, non-dedicated pump equipment between wells. Refer to ASTM, 1992, and USEPA, 1992.
4. Always shut off pump immediately when it is drawing air.
5. Some pumps are not made to pump extremely contaminated water (example: gas or diesel) and doing so could shorten the life of the pump. Check the manufacturer's specifications regarding this and other operating procedures. Follow the manufacturer's instructions regarding operation of any control mechanisms.
6. Micropurge Technique: Recent studies have indicated that low rate/low volume purging and low rate sampling at the screened interval using dedicated bladder or electrical submersible pumps is a viable alternative to traditional purging methods (e.g., 3-5 well volumes). Bailers and non-dedicated pumping equipment can not be used with this technique because they pass through the stagnant water column causing mixing. Micropurge may offer advantages in deep wells equipped with dedicated pumps, that would yield large amounts of purge water under traditional purging methods. USEPA (1992) recommends that a packer be placed above the screened interval to ensure that "stagnant" casing water is not drawn into the pump. For more information on the micropurge technique refer to USEPA, 1992, pg. 7-8; Kearn, et al., 1994; FERMCO, 1993; Barcelona, et al. 1994; Robin and Gillham, 1987; Puls and Powell, 1992 & 1993.



## THE WELL SHOULD BE SAMPLED AS SOON AS POSSIBLE AFTER PURGING IS COMPLETED

### 7. Sample Collection

#### a. Thoughts on Sampling Devices

Bailers or pumps, designed for groundwater sampling, may be used for sampling. This document does not dictate what type of sampling device to use. There is no one perfect sampling device for all parameters. All devices will alter the sample to some degree. Just the mere process of bringing the water to the surface changes the water chemistry. The decision as to what type of sampling device to be used must be made by the project manager,

including whether to use IEPA equipment or equipment supplied by the facility. This decision is dependent on the data quality objectives set for the project, the quality/cleanliness of the facility's equipment and the owner/operator degree of cooperation. Figures 7.1, 7.2, and 7.3 provide some examples of sampling devices. Some examples of references that discuss advantages and disadvantages of sampling with various types of pumps and bailers include: Ohio EPA, 1985; Nielsen, 1991; USEPA, 1992; Barcelona, et al, 1985b; ASTM Standard D4448.

Keep in mind the following from the Nielsen Environmental Field School Course:

1. Some pumps are not appropriate for sampling for volatile organic compounds. Beware of manufacturers that advertise "USEPA-approved" for VOC sampling. Do not believe this because the pump might not be reliable at all for sampling VOCs. There are no pumps that are officially "approved" for sampling VOCs, because there is no official approval process. Some pumps are less suitable or reliable than others and the above-referenced documents give some general recommendations regarding suitability. For example, some electrical submersible pumps draw the water in with a negative pressure then push it (positive pressure) through the impellers at rates up to 23,000 RPM (110 MPH). Peristaltic, surface centrifugal, and vacuum pumps operate by imparting a pressure lower than atmospheric pressure (i.e., suction and vacuum) to lift water to the surface through the tubing, which can volatilize the sample. The centrifugal electric submersible pump depends on water moving over the motor to cool it, and that water eventually becomes the sample. Increased pressure and temperature changes should be kept to a minimum because they cause degassing, stripping of VOCs and alteration of pH (which can change dissolved metal concentrations). This is not to say that all electrical submersible pumps are unsuitable for sampling VOCs. The rate of flow must be considered also. Positive displacement pumps, (except air-lift) such as bladder pumps are generally suitable for VOC sampling. Gear-drive pumps, and some electrical submersible pumps may also be considered for VOC sampling, with proper flow rates. If you want to use a pump for VOC sampling, (and there are many different types on the market), thoroughly research it first.
2. The most effective and efficient use of a sampling pump is to dedicate it to a well. Since the IEPA inspector will not usually be using dedicated sampling pumps, he/she will have to thoroughly decontaminate the pump between wells to reduce the risk of cross

contamination and provide for quality control samples to determine effectiveness of the cleaning procedures. USEPA, 1992, and ASTM D5088 contain decontamination procedures. Some pumps are difficult to take apart and clean in the field and large amounts of decon water will have to be hauled to the site.

b. General Sampling Procedures for All Monitor Wells

1. The monitoring well shall be sampled as soon as possible after purging is complete. VOC samples will be collected immediately, as they only require a volume of 80 ml. If there is not sufficient volume to collect the rest of the samples, they should be collected as soon as possible and no longer than 24 hours after purging is completed. Herzog et al. (1988) concluded that the common practice of next day sampling for low yield, slow recovery wells is adequate. For turbid wells, the well may be allowed to set for several hours (after organic samples are collected), to allow the sediments to settle down to obtain a total metals sample.
2. The water level may be allowed to drop below the top of the screen after volatile organic samples are collected because the inorganic parameters are less subject to volatilization effects.
3. Samples should not be transferred from one sample container to another as this may result in losses of constituents onto the walls of the container or sample aeration, except samples that need to be collected in a transfer vessel for field filtering.
4. Where non-dedicated, non-disposable sampling equipment is used, sampling should proceed from the least contaminated well to the most contaminated well. If this is unknown, sample the upgradient wells first.
5. Plastic sheeting should be spread on the ground near the well, if this hasn't already been done, or unless impractical.
6. Clean, chemical resistant protective gloves will be worn by each person in the sampling team who will be in direct contact with purging/sampling equipment. Each member of the team involved in sampling the well will wear clean protective gloves for each well.

7. Sampling should not be conducted in the rain unless some type of cover is provided which prohibits the precipitation from entering the well, bailer, and sample bottles. Suggestions: a large umbrella, or clean Visqueen or tarp stretched overhead at the sampling area.
8. pH, conductance, and temperature are to be measured and recorded after the sample is collected. All probes must be thoroughly decontaminated between wells.
9. Attachment 3 is an optional form that may be useful in the field for recording sampling information. This is one example of how information could be recorded, either on the form or in a field logbook.
10. As a rule of thumb, a minimum of two weeks should be allowed to pass after installation or well development to sample a newly installed well. This allows some time for the well to equilibrate hydraulically and chemically and recover from well installation trauma caused by substances introduced during well installation (drilling fluids, seals, and backfills). The actual waiting time could be several months in fine-grained formations and days to weeks in coarse-grained formations, depending on groundwater velocity, (Nielsen, 1995; Puls and Powell, 1992; Nielsen et al. 1991, pp.456-461).

c. Sampling with Bailers

1. If the well is a particularly muddy, turbid one, and the bailer is visibly contaminated after purging the well, discard (if disposable) the bailer and use a new one for sampling.
2. The bailer must be lowered slowly into the screened area to collect the sample without letting it touch the bottom of the well. The bailer should never be dropped into the well, as this will cause degassing of the water upon impact (USEPA, 1992). Fines resting on the bottom of the well will be stirred up and mobilized if the bailer touches the bottom.
3. Groundwater should be poured directly from the bailer into the sample bottles, unless the sample is to be filtered. Samples to be filtered may be collected in a transfer vessel (clean lab bottle).

4. Bailers are not to be reused from well to well unless they are properly decontaminated. If disposable bailers are used, a new bailer is to be used for each well.
5. New nylon cord will be used for each well. Teflon-coated stainless steel cable must be thoroughly decontaminated before re-using. It is common at industries that have many monitor wells to dedicate nylon cord or steel cable with a bailer. It is recommended to not use the facility's equipment if it is visibly contaminated.

d. Sampling with Pumps

1. If samples are being collected with a pump, consider the following factors:
2. Some pumps are not made to pump extremely contaminated water (example: gas or diesel) and doing so could shorten the life of the pump. Check the manufacturer's specifications regarding this.
3. For high or low yield wells, place the pump intake at or just above the well screen for sampling.
4. The flow rate should not exceed 100 ml/min to avoid agitation and reduce the loss of volatiles (Barcelona et al. 1985, USEPA)
5. Follow the manufacturer's instructions regarding operation of any control mechanisms.
6. The pump must be appropriate for the sampling objectives and data quality objectives.
7. The pump must be properly decontaminated between sampling each monitor well.

e. Handling Sample Bottles

1. Protective gloves should be worn when removing lids from preserved sample bottles.

2. No sample bottles or clean sampling equipment will be placed directly on the ground.
3. Lids are to be kept on the sample bottles at all times except during filling. It is preferable to hold the inside of the lid upside down while filling the bottle instead of actually setting it down. Nothing is to touch the inside of the bottle/lid except groundwater.
4. Bottles with preservatives in them cannot be overfilled or rinsed.

☀ Don't let the bottles sit in the sun after they are filled. During the warm season, as soon as possible, "supercool" the filled bottles by placing them directly on crushed or cubed ice. To reduce the chance of cross contamination, place the bottles in food-grade plastic bags before setting them on the ice. When they have been chilled they should be placed in their appropriate coolers with double-bagged cubed ice, ice blocks, blue ice or dry ice. Be careful when using dry ice as it can freeze samples as well as burn you. Be aware that methylene chloride has been detected in some blue ice. Reduce exposure of bottles to the blue ice by bagging the blue ice, bagging the sample bottles with food-grade plastic bags. It is highly suggested to always place the VOC vials in food-grade ziplock baggies to protect them from the blue ice.

☞ If you choose to double-bag the ice, remember that ziplock baggies will leak. Place the ice in a ziplock baggie and place that in a tie-off baggie to prevent leakage. Coolers that contain samples must be filled with new ice daily during warm weather. If samples are not delivered on the same day they were collected.

5. A photo should be taken of the sealed sample next to the well.

f. Order of Sample Collection

1. Samples should be collected and containerized in order of volatilization sensitivity of the parameters. VOC bottles should be filled first.

The order of collection for filling samples bottles is as follows:

1. VOCs
2. Semi-Volatiles
3. Phenols
4. Total Metals\*
5. Cyanide
6. Unpreserved & Unfiltered Parameters
7. Total Nutrients
8. Dissolved Parameters (Inorganics to be field filtered)
9. Collect Field Measurements (Ph, conductance, temperature)

**\*Collection of Total Metals:** If after taking all the precautions during purging to avoid agitation of the groundwater, the well is still visibly turbid, the following steps may be taken to reduce turbidity of the total metals sample.

- a. The well may be allowed (after collection of VOCs and S-VOCs), to set for several hours to allow fines to settle in the well and reduce turbidity prior to collection of the total metals sample; **OR**,
- b. Immediately after VOC and S-VOCs are collected, collect the Total Metals sample in an unpreserved plastic sample bottle. The Total Metals sample may be allowed to set for several hours, (in a cooler on ice or in a refrigerator), to allow the fines to settle down and then slowly decanted into a preserved sample bottle to be turned in for analysis.

g. Volatile Organic Sampling

1. Samples for volatile organic analyses are to be collected immediately after purging and first in the preferred order of collection. They will be taken directly from the sampling device. Use of an interim container or transfer bottle is not acceptable. Volatile organic compounds and dissolved gases in the stagnant water column in the well may volatilize or effervesce in as few as two hours (Nielsen et al, 1991)

2. When sampling for VOCs, collection, handling, and containerization should not take place near a running motor or any type of exhaust system (Ohio EPA, 1995).
3. To collect the VOC sample: Tilt the 40-ml glass vial and fill it such that the water flows very slowly down the inside of the bottle. When the bottle is nearly filled, upright the bottle and continue filling a meniscus is formed. Care will be taken not to overfill the VOC vial, since it is a preserved bottle.
4. No headspace will remain in a VOC bottle after it is capped with a fluorocarbon-lined cap. To check for air bubbles, turn the bottle upside down and tap it gently on your palm. If any bubbles are present, the sample and bottle should be discarded and the samples recollected with a new preserved bottle. The container should not be "topped-off" to fill the additional head space. The bubble acts as a miniature air stripper and could alter the VOC concentration in the sample (USEPA, 1992, pg. 7-24; Nielsen, 1995, Ohio EPA, 1995).
5. Tighten the VOC cap securely. Do not over tighten the lid as the bottle could break or a leak could be formed.
6. One set (2 bottles) of VOC trip blanks will accompany the sample bottles in the field and to the lab for each day of sampling and for every set of 10 VOC samples (see section B.1.b.4.). Unless only one set of trip blanks are being submitted to the lab at a time, the blanks shall be labeled as to the date they were used.
7. VOC vials must be placed into food-grade plastic bags before placement into a cooler with blue ice.
8. The use of bottom emptying devices is discouraged. Bottom emptying devices are tubes or attachments that come with the bailers or can be purchased and attached to the bottom of the bailer to control flow. They could strip the sample of volatile constituents. The preferred method is to pour the sample slowly from the top of the bailer (Nielsen, 1995).

#### h. Split Samples

1. If the owner/operator (o/o), or their consultant, wishes to collect a groundwater sample at the same time the IEPA is sampling the



monitor wells, the resulting sample is called a split sample. The details of this type of sampling must be worked out prior to the field visit. Things to be considered are:

- a. IEPA is not obligated to provide o/o with sample bottles.
- b. IEPA will not provide lab services for the o/o portion of the split sample.
- c. Transfer vessels will not be used to composite the sample. VOC vials should all be filled from the same bailer. If this cannot be accomplished, alternately fill the IEPA and o/o bottles. For the rest of the bottles, fill the containers alternately until both are or split each bailer volume into two portions, one for the IEPA bottle and one for o/o bottle until the bottles are filled.
- d. If the well is low yield, a true split sample may be impossible to obtain. If there is a possibility of inadequate volume of groundwater and if the IEPA initiated and is conducting the sampling, IEPA bottles will be filled first. If the o/o or the consultants are conducting their routine quarterly or semi-annual sampling, the o/o bottles will be filled first.

## **8. Field Filtering**

- a. It is recommended that if metals samples are collected for dissolved analysis (field filtered), metals samples should also be collected for total (unfiltered) analyses.
- b. Groundwater samples below 5 Nethelometric Turbidity Units (NTU) should not be filtered (Ohio EPA, 1995, pg. 10-21; Puls and Powell, 1992; USEPA, June 1992). If the water exceeds 5 NTUs in turbidity, surburface geology should be considered. Field filtration should not be necessary when sampling from karst; bedrock with open, interconnected fractures; clean, highly porous gravel-to-boulder sized deposits; and any other formation characterized by a high degree of particle mobility (Ohio EPA, 1995).
- c. Samples for dissolved inorganic analysis (metals, chlorides, etc.) should be filtered as soon as possible.

- d. Filtering shall take place in a shaded area if possible. Avoid setting filled bottles in direct sunlight.
- e. Filtering may be conducted with a peristaltic pump (refer to figure 8.1) and silicone tubing as follows:
  1. Attach a .45 or 5 micron ( $\mu\text{m}$ ) disposable in-line filter cartridge to the tubing. Filter size is dictated by the sampling program. (e.g., RCRA or CERCLA, etc.). If the 5 micron cartridge is used, an adapter is necessary to attach it to the tubing. Note the flow direction indicated by an arrow embossed on the side of the cartridge.
  2. The cartridge must be pre-conditioned by flushing it with about 8 to 16 oz. of distilled/deionized water or groundwater, to remove potential residues from the manufacturing process and to eliminate channel flow through the filter. If it is flushed with DI water, the DI water must be completely flushed out with groundwater prior to filtration of the sample.
  3. If filtering the following groundwater samples, filter them into their appropriate pre-labeled bottles in the following order:
    - Metals
    - Nutrients
    - Others: Chloride, fluoride, sulfates, alkalinity
  4. Place the filled bottles into a cooler with ice or blue ice as soon as they are collected and/or after they are photographed.
  5. Discard the used filter cartridge and use a new one for each different monitor well sample.
  6. Change the silicone tubing between filtering samples from different wells.

## **9. Lost Bailers**

- a. If a bailer is lost down a well, a fishing kit consisting of heavy fishing line, large treble hooks, and weights (preferably stainless steel), should be used to "fish" it out. Such a kit should be included as standard equipment so time is not wasted going to a store to buy the necessary gear.

- b. Attach the hook and weight to the line and lower the line into the well to the approximate depth of the bailer. Work it up and down until you have caught the bailer.
- c. Lightweight polyethylene and teflon bailers are easily fished out of a shallow well, unless they are stuck. It is much more difficult to fish out a heavy stainless steel bailer or a bailer in a deep well.
- d. Dropping the bailer allows it to sink to the bottom of the well, stirring sediments on the bottom, and increasing the turbidity of the sample. Precautions should be taken to avoid losing a bailer. Tie very secure knots when attaching the nylon cord to the bailer and tie the other end to your wrist while using the bailer.
- e. If a bailer consistently gets "hung up" on the inner casing of the well, it can get lodged (possibly permanently) or the bailer line can break. If this situation occurs, switching to a smaller diameter bailer or different purging/sampling device is advisable.

#### 10. Documentation of the Sampling Event

The information listed below should be logged in the field for each day of the sampling event. Attachments 2 and 3 are optional forms that may be useful in the field to help document some of this information.

- 1. A chronological listing of significant site events and sampling team activities.
- 2. Air temperature, wind direction, recent rainfall, presence of ponded water.
- 3. Names of sampling team members, facility representatives and officials.
- 4. Results of each monitor well inspection (i.e.: was well locked?, degradation of casing; ponded water around well; evidence of heaving or subsidence; vented caps and drain hole present?). Refer to Attachment 2 for a monitor well inspection checklist.
- 5. Identification number of each monitor well.
- 6. Direct reading instrument measurements around well head.

7. Diameter of well and purge volume calculations.
8. Static water level and total depth of well measurements. Note if siltation has occurred.
9. Well purging procedure and type of equipment used, date and time. Name of person who purged well.
10. Purge volume and pumping rate.
11. Measurements of pH, specific conductance or millivolt readings, temperature during purging activities, equipment used to collect these measurements, and calibration procedures for this equipment.
12. Physical characteristics of the groundwater as it is being purged and sampled (color, odor, turbidity).
13. Well recharge rate: fast, slow, dry, etc.
14. Sample withdrawal procedure and equipment used, date and time of sampling, names of samplers.
15. Types and numbers of sample containers and preservatives used (not necessary to log in the field if this information was included in a sampling and analysis plan).
16. Time of filtering/preservation of filtered samples and equipment/procedure used to filter them and which parameters were filtered.
17. Parameters requested for analyses.
18. Sample transportation and delivery procedures.
19. Photographs of the sample and the sample location and the direction and time the photo was taken.
20. Any deviations from the original sampling and analysis plan.

The above information will be compiled and transferred to the appropriate forms (e.g., Chain of Custody Form) and will be included in the final written

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**Other Relevant References:**

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**E. ATTACHMENTS**

1. Monitor Well Inspection Checklist.
2. IEPA Monitor Well Sampling Inspection Form.





## ATTACHMENT 2

### IEPA/BOL MONITOR WELL SAMPLING INSPECTION FORM

Well# \_\_\_\_\_

Site \_\_\_\_\_

LPC# \_\_\_\_\_

#### APPROACHING THE WELL

Date \_\_\_\_\_ Inspectors \_\_\_\_\_ Weather \_\_\_\_\_

Weather \_\_\_\_\_

PID Response \_\_\_\_\_ Passport \_\_\_\_\_

Other \_\_\_\_\_

#### INSPECTING THE WELL

Date \_\_\_\_\_ Inspectors \_\_\_\_\_ Weather \_\_\_\_\_

Locked? \_\_\_\_\_ Assess Integrity of: \_\_\_\_\_

Labeled \_\_\_\_\_ Surface \_\_\_\_\_

Seal \_\_\_\_\_

Cap Vent \_\_\_\_\_ Inner \_\_\_\_\_

Casing \_\_\_\_\_

Drain Hole \_\_\_\_\_ Outer \_\_\_\_\_

Casing \_\_\_\_\_

Ponded Water \_\_\_\_\_

Comments \_\_\_\_\_

#### WELL MEASUREMENTS

Date \_\_\_\_\_ Inspectors \_\_\_\_\_ Weather \_\_\_\_\_

1. Depth to water from

MP \_\_\_\_\_

2. Total Depth from

MP \_\_\_\_\_

3. MSL elevation, top of Measuring

Point \_\_\_\_\_

4. Elevation of Groundwater (3-1)

\_\_\_\_\_

\_\_\_\_\_

**PURGING INFORMATION**

Date \_\_\_\_\_ Inspectors \_\_\_\_\_ Weather \_\_\_\_\_

5. Linear Feet of water in well (2-1) \_\_\_\_\_

6. Gallons of Water in Well (linear feet X 0.163 = gal. of water in 2-in. Casing) \_\_\_\_\_

7. Total Gallons of water to purge \_\_\_\_\_

8. Gallons of water purged \_\_\_\_\_ Dry? \_\_\_\_\_ Purged  
with \_\_\_\_\_**SAMPLING INFORMATION**

Date \_\_\_\_\_ Inspectors \_\_\_\_\_ Weather \_\_\_\_\_

Well Sampled with: Bailer(type) \_\_\_\_\_ Pump (type) \_\_\_\_\_ Pump  
Rate \_\_\_\_\_

Parameters	Sample Date	Sample Time	Seal Date	Seal Time
Organics (VOC & S-				
Total Inorganics				
Diss'd Inorganics				

Filter Time \_\_\_\_\_

Temp \_\_\_\_\_

pH \_\_\_\_\_

SC or MV \_\_\_\_\_

Total = Not field filtered, Diss'd = Field Filtered

Photo \_\_\_\_\_

Sample  
Appearance/Notes \_\_\_\_\_\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

C:\EPA4312\G

WGWSQAT.WPD

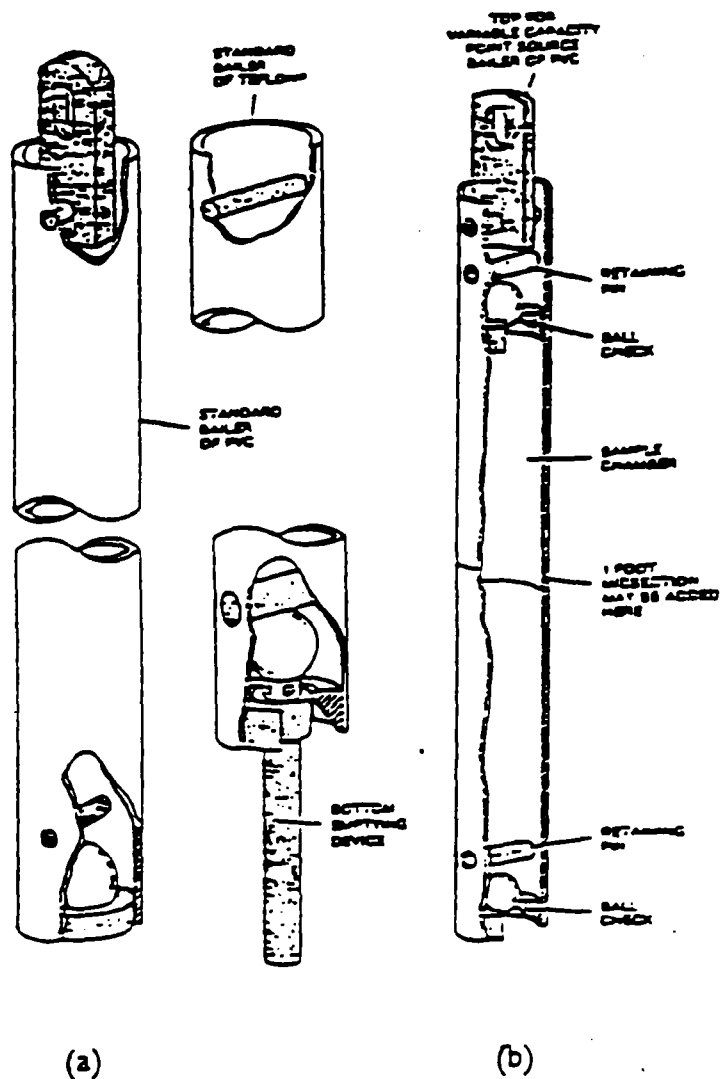
## **F. FIGURES**

7a -- Disposable Bailer

7b -- Electric Submersible Pumps

7c -- Suction-Lift Pumps

# FIGURE 7a - DISPOSABLE BAILER



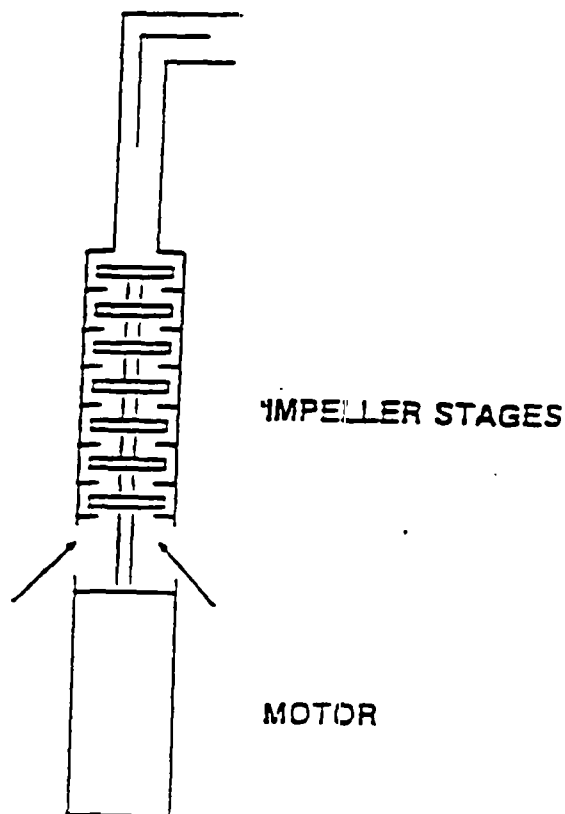
Bailers: (a) Standard type; (b) Point-source type (Gillham et al., 1963, by permission).

(USEPA, 1993)

**FIGURE 7b**

## **ELECTRIC SUBMERSIBLE PUMPS**

- Pumps that Are Configured with an Electrical Motor Below the Pumping Mechanism, Which Draws Water into an Intake Under Slight Suction, Then Pressurizes it, Either Through Centrifugal Force or Positive Displacement, to Drive the Water Through a Discharge Line to the Surface. Water Passing By/Through the Pump Cools the Motor and Lubricates the Pump and Motor Seals.
- Includes Centrifugal Submersible, Gear and Helical Rotor (Progressing Cavity) Pumps



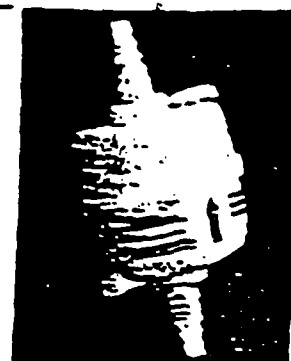
**ELECTRIC SUBMERSIBLE PUMP**

(NIELSEN, 1995)

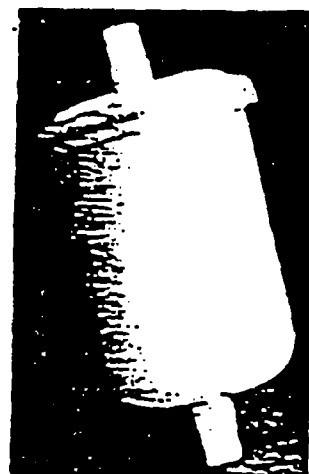
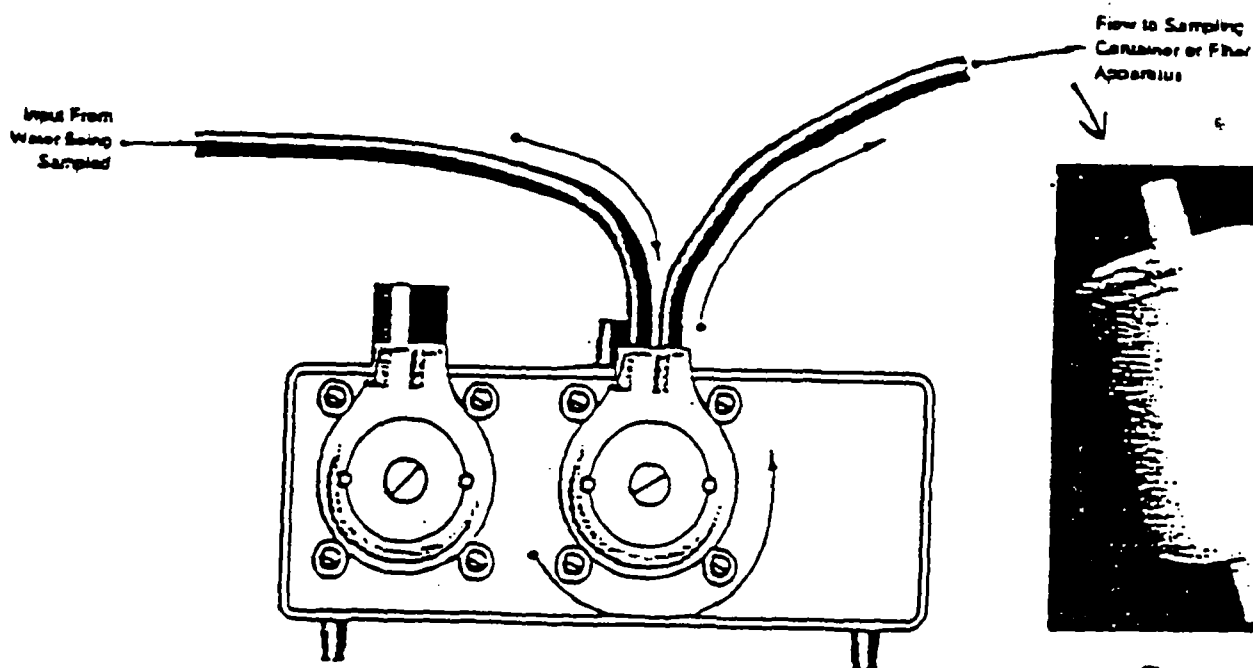
**FIGURE 7c**

## SUCTION-LIFT PUMPS

- Pumps that Operate by Imparting a Pressure Lower Than Atmospheric Pressure (i.e. Suction or Vacuum) to Lift Water to the Surface Through an Intake Pipe, Tubing or Hose.
- Includes Peristaltic, Surface Centrifugal and Vacuum Pumps.



Groundwater  
Sampling Capsule



Groundwater  
Sampling Filter

(NIELSEN, 1995)

# **SECTION VIII: PRIVATE DRINKING WATER WELL SAMPLING**

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## SECTION VIII: PRIVATE DRINKING WATER WELL SAMPLING

### A. REMINDER CHECKLIST

#### 1. Pre--Sampling Activities

- \_\_\_ Assess site hazards, and develop and/or review a safety plan.
- \_\_\_ Develop and/or review sampling plan.
- \_\_\_ Establish purpose(s) of sampling.
- \_\_\_ Obtain necessary sampling and monitoring equipment; decontaminate or pre-clean the equipment, and ensure that it is in working order.
- \_\_\_ Bring enough clean water for rinsing, cleaning, and cooling off.
- \_\_\_ Schedule lab time and order your bottles two weeks in advance. Be sure to inform the laboratory and bottle preparation staff that your order includes drinking water samples.
- \_\_\_ Be prepared to sample in extreme weather conditions, if applicable.
- \_\_\_ Schedule a meeting prior to the trip to ensure all sampling team members understand their role and responsibilities.
- \_\_\_ If necessary, contact owner/operator prior to the trip to schedule the sampling event, to gain access to the site, to discuss the purpose of the sampling event, and to address any safety and security concerns at the site.
- \_\_\_ Identify local suppliers of sampling expendables (e.g., ice, plastic bags) and overnight delivery services (e.g., Federal Express), and recharge of SCBA air tanks (local Fire Dept.).
- \_\_\_ Identify private water well users. Obtain required access agreements. Schedule convenient time to sample well.
- \_\_\_ Prepare your sample containers prior to sampling (label and organize).



## **2. During Sampling Activities**

Note: When sampling potable water supplies, utmost care must be taken to insure that samples are representative of the water supply being sampled. This is important not only from a technical and public health perspective, but also from a community relations standpoint. Poor sampling techniques may result in incorrect results (either not detecting a compound which is present or by contaminating the sample and falsely indicating a compound which is not present). If incorrect results are disclosed to the public, it may be impossible to change public opinion when correct results are reported.

Several rules of common sense can make a difference when speaking to citizens and will help avoid additional work in the future. It is important to inform the homeowner of ongoing sampling activities and procedures, to eliminate any confusion they might have, and to answer questions as accurately as possible. When sampling residential wells, you are representing the Agency. To earn credibility, you must provide the best possible assistance to the resident and maintain a professional attitude at all times.

### **When communicating with citizens...**

- \* be honest; admit when you do not know an answer to a question;
- \* keep explanations simple but not condescending or patronizing;
- \* speak in a volume appropriate to the situation - oftentimes older persons may be hard of hearing;
- \* do not make promises you cannot or will not keep. Follow through if you promise to provide them with additional information, answers or assistance;
- \* maintain control and do not lose your temper despite irritating confrontations; remain calm and do not use foul or offensive language;
- \* wear attire that is appropriate for the situation: and
- \* clean up any mess caused from sampling, i.e. water paper towels and disposable gloves.

\_\_\_\_ Document the sampling event. At a minimum, include weather conditions, date, time, sampler's name, photographs, any deviations from the original sampling plan, and any problems encountered.

- \_\_\_ Collect samples in order of volatilization. Special care is taken when collecting VOC samples.
- \_\_\_ If necessary, monitor the air in the area where sampling is taking place so that you can adjust your level of protection.
- \_\_\_ Keep sample bottles in coolers properly preserved, sealed and maintain chain of custody.
- \_\_\_ Never composite VOC samples.
- \_\_\_ Wipe off outside of sample bottles prior to placement in cooler.
- \_\_\_ Measure pH, specific conductance, and water temperature.
- \_\_\_ Follow proper procedures to ensure sample is representative of groundwater.
- \_\_\_ Purge well prior to taking sample.
- \_\_\_ Follow proper procedures to avoid air bubbles or contamination of samples.
- \_\_\_ Have homeowner complete IEPA Private Well Sample Collection Form.

### **3. Post-Sampling Activities**

- \_\_\_ Decontaminate all field equipment and PPE if appropriate, in accordance with the Health and Safety Plan. Return all reusable equipment to the IEPA warehouse or its place of origin.
- \_\_\_ Classify all waste generated (i.e., IDW = cuttings, rinse waters, baggies, contaminated PPE) and dispose of properly.
- \_\_\_ Keep samples cool; ship or drop off to appropriate laboratory.
- \_\_\_ Separate incompatible wastes so that they are not transported in the same cooler.
- \_\_\_ Seal odorous wastes in a cooler to avoid breathing vapors or odors during transportation.
- \_\_\_ Clean up any mess you may have made; homeowners will notice.

- \_\_\_\_\_ If the homeowner is present, indicate when laboratory results will be back. Inform him/her IDPH will contact them with results.
- \_\_\_\_\_ After receiving results, make sure that IDPH follows up with a phone call or letter explaining results to citizens.

## **B. EQUIPMENT**

See equipment checklist below.

## SAMPLING EQUIPMENT CHECKLIST

### PAPERWORK:

- ☐ IEPA Identification
- ☐ Safety Training Certification
- ☐ Lab Phone Numbers
- ☐ Site Map & Directions
- ☐ Chemical Analysis Forms
- ☐ Chain of Custody Forms
- ☐ Receipt for Samples (RCRA sites only)
- ☐ Field Log Forms or Field Log Book

### PROJECT MANAGER:

- ☐ Field Logbook
- ☐ Aluminum Case (for paperwork)
- ☐ Calculator
- ☐ Camera
- ☐ Pencils & Pens
- ☐ China Markers
- ☐ Compass
- ☐ Pocket Knife
- ☐ Emergency Raingear
- ☐ Paper Towels
- ☐ PPE Gloves \_\_\_\_\_ L \_\_\_\_\_ XL
- ☐ pH Paper
- ☐ Decon Spray Bottles:
  - ☐ Liquinox Solution
  - ☐ Deionized/Distilled Water

### GENERAL SAMPLING EQUIPMENT:

- ☐ Sample Bottles
- ☐ Extra Bottle Labels
- ☐ Waterproof Clear Tape
- ☐ Visqueen (pre-cut)
- ☐ Utility Knife or Pocket Knife
- ☐ Portable Table
- ☐ Garbage Bags
- ☐ Rain Canopy & Poles
- ☐ Nylon Rope
- ☐ Water Carriers
- ☐ Paper Towels
- ☐ Duct Tape
- ☐ Masking Tape
- ☐ Flashlights & Batteries
- ☐ Binoculars
- ☐ Aluminum Foil
- ☐ Shovel
- ☐ Trowel/Sampling Spoons
- ☐ Machete

### FOR DECON:

- Spray Bottles:
  - ☐ Liquinox Solution
  - ☐ Distilled/Deionized Water
- 1/2-Gallon Jugs:
  - ☐ HCL; dilute to 5 or 10%
  - ☐ Liquinox Solution
  - ☐ DI Water
- 5-Gallon Sprayers:
  - ☐ Liquinox Solution
  - ☐ Tap Water
  - ☐ Extra Gallons of DI Water
- ☐ Paper Towels
- ☐ Aluminum Foil
- ☐ Brushes
- ☐ Plastic Tubs
- ☐ 5-Gallon Plastic Buckets
- ☐ Garbage Bags

### FOR FIELD MEASUREMENTS:

- ☐ Passport
- ☐ PID
- ☐ FID
- ☐ pH/Temp/Millivolt Meter
  - ☐ Battery; 9-volt
- ☐ pH Buffers; 4, 7, & 10
- ☐ Radiation Detector
- ☐ Draeger Pump, Tubes

### PPE, SAFETY & SUPPORT:

- ☐ Cleaning & Cooling Water
- ☐ Drinking Water
- ☐ Gatorade
- ☐ Ice for Drinking Water
- ☐ Hand Soap/Goop
- ☐ First Aid Kit
- ☐ Insect/Tick Repellant
- ☐ Sunscreen
- ☐ Fire Extinguishers
- ☐ Walkie Talkies
- ☐ Full-Face Respirators
- ☐ Cartridges
- ☐ SCBAs
- ☐ Cylinders
- ☐ Field Chairs
- ☐ Disposable Booties
- ☐ Tyvek
- ☐ Saranex
- ☐ Raingear
- ☐ Cotton Coveralls
- ☐ Insulated Coveralls
- ☐ Steel-Toed/Shanked Boots
- ☐ Insulated Pack-Boots
- ☐ Hardhat/Face Shields
- ☐ Nitrile/Butyl Rubber/Neoprene Gloves
- ☐ Glove Liners

### SEALING & TRANSPORTATION

- ☐ Coolers
- ☐ Blue Ice
- ☐ Dry Ice
- ☐ Regular Ice
- ☐ Large Liners for Coolers
- ☐ 1-Gallon Ziplock Bags
- ☐ Quart Ziplock Bags
- ☐ Large FDA Cooler Bags
- ☐ Evidence Tape
- ☐ Strapping Tape

## C. PROCEDURES

Even though the same care and techniques used in other media sampling (i.e., ensuring that all field equipment is available and in good working order, confirming that sample coolers contain sufficient ice or cool packs to chill all anticipated samples to less than four (4) degrees Centigrade for at least twelve hours, completing chain-of-custody forms, etc.) are used when sampling private water wells, there are certain additional special procedures which shall be used.

1. Primary groundwater parameters for drinking water samples measured in the field, in addition to the specific parameters ordered for laboratory analysis, include pH, specific conductance, and water temperature.
  - a. Begin with a clean, well-functioning instrument, and calibrate each day for accuracy by measuring known standards. Follow the instructions provided with the equipment to ensure proper calibration.
  - b. Avoid dehydration of sensors, extreme temperatures, and excessive vibration when transporting the instrument to the field. All of these factors can affect the sensitivity of the equipment and damage various parts of the system.
2. To ensure that the water sample is representative of the groundwater, you must avoid altering the sample with outside sources of contamination.
  - a. Ask if the owner obtains water from any other sources, i.e. whether water is hauled in.
  - b. Wear latex gloves without talc. Latex gloves are also worn to avoid burning your hands with the HCL preservative contained in the vial when filling VOC bottles.

**Note:** Oftentimes the homeowner will wonder if his/her drinking water is so badly contaminated that we must protect our hands while collecting the sample. Reassure the person that the gloves are used to ensure that the sample collected is not being contaminated by us or to avoid acid burns from the preservatives.

- c. Collect the sample at a point prior to introduction into a water heater, holding tank, cistern, water softener/conditioner, or home filtering system.
- d. Protect the sampling tap from exterior contamination associated with being too close to the sink bottom or to the ground. Contaminated water or soil from the faucet exterior may enter the bottle during the collecting

procedure since it is difficult to place a bottle under a low tap without grazing the neck interior against the outside faucet surface.

- e. Avoid leaking taps that allow water to flow out from around the stem of the valve handle and down the outside of the faucet, or taps in which water tends to run up on the outside of the lip.
  - f. Remove any aerator and/or water hose from the tap prior to sample collecting.
3. To obtain a representative sample from private wells, the wells must be purged before the sample is collected.

- a. Open the cold water tap to allow for a smooth flow at a moderate pressure. The rate of flow can be measured easily by placing a one-gallon calibrated bucket under the tap and measuring the time required to fill the bucket. The tap must be allowed to run until the temperature, pH, and specific conductivity readings become stabilized to ensure water standing in the well or holding tank is removed.

Often the homeowner will request that you not waste his/her water while purging the well. Therefore, you may want to use this running water on a garden or flower bed. However, the those must be removed prior to collecting the sample.

- b. Measure the temperature, pH, and specific conductivity at the initial purging, after ten minutes of purging, and again immediately prior to the sample collection.
- c. Record unusual physical characteristics, color, odor or turbidity in the groundwater in the field notes.
- d. Do not place the bottle cap on the ground or in a pocket regardless of the type of sample bottle being used.
- e. Hold the bottle in one hand and the cap in the other, using care not to touch the inside of the cap.
- f. Avoid contaminating the sample bottle with fingers or permitting the faucet to touch the inside of the bottle.
- g. Take care when filling any container so splashing drops of water from the ground or sink do not enter into either the bottle or cap.

- h. Do not adjust the stream flow while sampling to avoid dislodging particles in the pipe or valve.
4. When collecting drinking water samples for volatile organic chemicals, contract laboratories require that the pH of the sample be lowered by the addition of three drops of 1:1 hydrochloric acid (HCL) to each bottle. Vials obtained from the Bottle Distribution Center already contain the prescribed amount of HCL. Take special care when handling the HCL; wear disposable gloves to avoid burning your hands.
- a. Carefully fill the vial to slightly above the rim but not enough to allow the sample to overflow. Overflowing the bottle will result in loss of the preservative.
  - b. Exercise care not to lose the Teflon liner.
  - c. Do not rinse the vial, nor excessively overfill it. There should be a convex meniscus on the top of the vial.
  - d. Check that the cap has not been contaminated.
  - e. Place the sample vial on a level surface.
  - f. Position the Teflon side of the septum seal directly over top and upon the convex sample meniscus. For the best results, lower the cap on to the sample - do not place it on the sample sideways; placing the cap on sideways will knock off the meniscus and result in air bubbles in the sample.
  - g. Screw the cap down firmly - do not over tighten and break the cap.
  - h. Invert the vial and tap gently on the palm of your hand. A successful seal is one in which no air bubbles are present in the sample.

*(When collecting drinking water samples for volatile organic contaminants, contract laboratories require five 40 ml vials of water sample. Agency laboratory requires two 40 ml vials)*

- i. Pre-label sample bottles appropriately. (Avoid opening permanent or magic marker around open sample vial.)
- j. Wipe off the sample container with paper towel.
- k. Wrap each vial with plastic bubble wrap.

- l. Place each set of five into plastic Zip-loc bags and seal baggie with evidence tape.
- m. Place into coolers, ensuring four (4) degrees centigrade is maintained surrounding the samples. Do not place vials directly on ice to avoid breaking of bottles.

If air is trapped in the bottle:

- Open the vial and add a few additional drops of water and reseal the bottle as indicated above. If bubbles persist, pour out, obtain a new sample bottle, and repeat entire process.

## D. REFERENCES

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# **SECTION IX: SURFACE WATER**

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## SECTION IX: SURFACE WATER

### A. REMINDER CHECKLISTS

#### 1. Pre-Sampling Activities

- \_\_\_ Assess site hazards and develop and/or review a safety plan.
- \_\_\_ Develop and/or review a sampling plan.
- \_\_\_ Establish purpose(s) of sampling.
- \_\_\_ Obtain necessary sampling and monitoring equipment; decontaminate or preclean the equipment, and ensure that it is in working order.
- \_\_\_ Bring enough clean water for rinsing, cleaning, and cooling off.
- \_\_\_ Schedule lab time and order your bottles 2 weeks in advance.
- \_\_\_ Be prepared to sample in extreme weather conditions, if applicable.
- \_\_\_ Schedule a meeting prior to the trip to ensure all sampling team members understand their role and responsibilities.
- \_\_\_ If necessary, contact owner/operator prior to the trip to schedule<sup>t</sup> the sampling event, to gain access to the site, to discuss the purpose of the sampling event, and to address any safety and security concerns at the site.
- \_\_\_ Identify local suppliers of sampling expendables (e.g., ice, plastic bags) and overnight delivery services (e.g., Federal Express), and recharge of SCBA air tanks (local Fire Dept.).
- \_\_\_ Become familiar with the impoundment, such as where the waste enters the unit, where the waste exits the unit (if applicable), and accessibility to the unit.
- \_\_\_ If sludge samples are required, refer to Section X of this document for additional guidance.
- \_\_\_ Prepare your sample containers prior to sampling (label and organize).

## **2. During Sampling Activities**

- \_\_\_ Document the sampling event. At a minimum, include weather conditions, date, time, sampler's name, photographs, any deviations from the original sampling plan, and any problems encountered.
- \_\_\_ Collect samples in order of volatilization. Special care is taken when collecting VOC samples.
- \_\_\_ If necessary, monitor the air in the area where sampling is taking place so that you can adjust your level of protection.
- \_\_\_ Keep sample bottles in coolers properly preserved, sealed and maintain chain of custody.
- \_\_\_ Never composite VOC samples.
- \_\_\_ Wipe off outside of sample bottles prior to placement in cooler.
- \_\_\_ Sample bottles with preservatives cannot be overfilled (liquid samples).
- \_\_\_ Photograph sample containers at sample location.

## **3. Post-Sampling Activities**

- \_\_\_ Decontaminate all field equipment and PPE, if appropriate, in accordance with the Health and Safety Plan. Return all reusable equipment to the IEPA warehouse or its place of origin.
- \_\_\_ Classify all waste generated (i.e., IDW = cuttings, rinse waters, baggies, contaminated PPE) and dispose of properly.
- \_\_\_ Keep samples cool; ship or drop off to appropriate laboratory, in accordance with BOL SOP for Sampling Packaging and Shipping.
- \_\_\_ Separate incompatible wastes so that they are not transported in the same cooler.
- \_\_\_ Seal odorous wastes in the cooler to avoid breathing vapors or odors during transportation.
- \_\_\_ Make sure water reactive wastes are not transported with water or ice.

## **B. EQUIPMENT CHECKLIST**

The selection of the sampling devices should be based upon waste properties (e.g., liquid or solid), site factors (e.g., waste accessibility, waste generation practices, and degree of hazard), and the analytes to be quantitated (e.g., VOCs or heavy metals). Ease of use under the site conditions and the degree of hazard associated with using a given device should also be considered. Refer to the following table to determine equipment needs.

## SAMPLING EQUIPMENT CHECKLIST: SURFACE WATER

### PAPERWORK:

- ☐ IEPA Identification
- ☐ Safety Training Certification
- ☐ Lab Phone Numbers
- ☐ Site Map & Directions
- ☐ Chemical Analysis Forms
- ☐ Chain of Custody Forms
- ☐ Receipt for Samples (RCRA sites only)
- ☐ Field Log Forms or Field Log Book

### PROJECT MANAGER:

- ☐ Field Logbook
- ☐ Aluminum Case (for paperwork)
- ☐ Calculator
- ☐ Camera
- ☐ Camera Battery
- ☐ Pencils & Pens
- ☐ China Markers
- ☐ Compass
- ☐ Pocket Knife
- ☐ Emergency Raingear
- ☐ Paper Towels
- ☐ PPE Gloves ☐ L ☐ XL
- ☐ pH Paper
- ☐ Decon Spray Bottles:
  - ☐ Liquinox Solution
  - ☐ Deionized/Distilled Water

### GENERAL SAMPLING EQUIPMENT

- ☐ Sample Bottles
- ☐ Clean Glass Tubes
- ☐ Extra Sample Bottles
- ☐ Extra Bottle Labels
- ☐ Waterproof Clear Tape
- ☐ Visqueen (pre-cut)
- ☐ Utility Knife or Pocket Knife
- ☐ Portable Table
- ☐ Garbage Bags
- ☐ Rain Canopy & Poles
- ☐ Nylon Rope
- ☐ Water Carriers
- ☐ Paper Towels
- ☐ Duct Tape
- ☐ Masking Tape
- ☐ Flashlights & Batteries
- ☐ Binoculars
- ☐ Aluminum Foil
- ☐ Shovel

### FOR DECON:

#### Spray Bottles:

- ☐ Liquinox Solution
- ☐ Distilled/Deionized Water

#### 1/2-Gallon Jugs:

- ☐ HCL; dilute to 5 or 10%
- ☐ Liquinox Solution
- ☐ DI Water

#### 5-Gallon Sprayers:

- ☐ Liquinox Solution
- ☐ Tap Water
- ☐ Extra Gallons of DI Water

- ☐ Paper Towels
- ☐ Aluminum Foil

- ☐ Brushes
- ☐ Plastic Tubs
- ☐ 5-Gallon Plastic Buckets
- ☐ Garbage Bags

### FOR FIELD MEASUREMENTS:

- ☐ Passport
- ☐ PID
- ☐ FID
- ☐ TVA
- ☐ pH/Temp/Millivolt Meter
- ☐ Battery; 9-volt
- ☐ pH Buffers; 4, 7, & 10
- ☐ Radiation Detector
- ☐ Draeger Pump, Tubes

### PPE, SAFETY & SUPPORT:

- ☐ Cleaning & Cooling Water
- ☐ Drinking Water
- ☐ Gatorade
- ☐ Ice for Drinking Water
- ☐ Hand Soap/Goop
- ☐ First Aid Kit
- ☐ Insect/Tick Repellant
- ☐ Sunscreen
- ☐ Fire Extinguishers
- ☐ Walkie Talkies
- ☐ Full-Face Respirators
- ☐ Cartridges
- ☐ SCBAs
- ☐ Cylinders
- ☐ Field Chairs
- ☐ Disposable Booties
- ☐ Tyvek
- ☐ Saranex
- ☐ Raingear

### SEALING & TRANSPORTATION

- ☐ Coolers
- ☐ Blue Ice
- ☐ Dry Ice
- ☐ Regular Ice
- ☐ Large Liners for Coolers
- ☐ 1-Gallon Ziplock Bags
- ☐ Quart Ziplock Bags
- ☐ Large FDA Cooler Bags
- ☐ Evidence Tape
- ☐ Strapping Tape

### SPECIFIC SAMPLING

#### EQUIPMENT:

- ☐ Disposable Dippers

## C. PROCEDURES

Make sure appropriate protective gear is worn and all necessary safety precautions are taken prior to collecting samples.

### 1. Liquid Sampling

Most surface water samples are grab samples and are collected by immersing the dipper or the sample bottle in the body of water. A sample of a dipper can be seen on Figure 9a.

Note: Samples for VOC analysis are collected first. When obtaining samples for volatile organic analysis, it is important to exclude any air space in the top of the bottle. However, when sampling running water (e.g., a stream or creek), the order in which samples are collected may not be important.

- a. Position yourself to collect sample without taking any unnecessary risks.
- b. Holding the end of the rod opposite the dipper, lower dipper until it is completely below the surface (or to a specific depth) and collect grab sample. If you are standing in a stream or pond, or can get very close to the stream or pond, you can fill the sample bottles (with no preservatives) directly from the stream. If not, a dipper must be used. For glass sample bottles, a glass dipper must be used. For plastic sample bottles, a plastic dipper must be used.
- c. Transfer grab sample to appropriate sample container, continuing until you have collected the necessary number of samples for this location.
- d. Remove dipper from the rod and place dipper in a trash bag.
- e. Decontaminate the end of the rod, if necessary.
- f. Move to the next sampling location.
- g. Attach another dipper and repeat steps (a) through (e).

#### Additional suggestions:

- h. The sample container should be rinsed at least once with the water to be sampled before the sample is taken. Be aware that it is fine to rinse the bottles that do not have preservatives, but it is not necessary because all bottles are supposed to be clean that we obtain for the labs. Obviously, bottles with preservatives cannot be rinsed out.

- i. For sampling running water, the farthest downstream sample should be obtained first, then move upstream. This avoids contaminating samples by raising the stream turbidity levels. Work from zones of low contamination to zones of high contamination. Always stand on downstream side to avoid sediment contamination.
- j. To sample a pond or other standing body of water, the surface area may be divided into grids. A series of samples taken from each grid is combined into one sample, or several grids are selected at random.
- k. Stagnated areas or pools in a stream or river might contain zones of varying pollutant concentrations, depending upon the physical or chemical properties of the contaminants and the position of these stagnated areas relative to the site.
- l. Avoid excessive agitation of the water since this results in the loss of volatile constituents.
- m. Do not sample at the surface unless sampling specifically for a known constituent which is immiscible and on top of the water. Invert the dipper or sample container, lower it to the desired depth, and hold it at about a 45° angle with the mouth of the dipper or sample container facing upstream.

## 2. Sediment Sampling

Refer to Section X (Sediments).

## D. REFERENCES

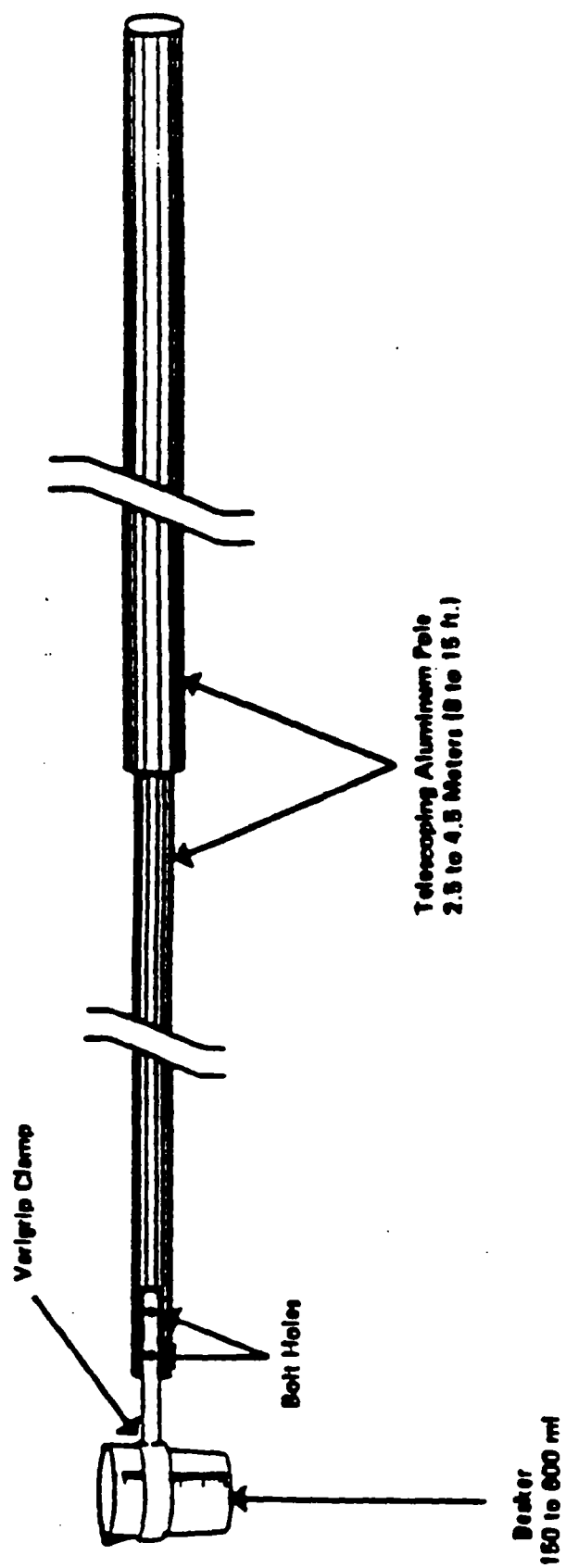
- Illinois Environmental Protection Agency, Remedial Project Management Section.  
Methods & Procedures Manual for Activities Undertaken Under the Preliminary Assessment/Site Inspection Program, 1987.
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Test Methods for Evaluating Solid Waste. Physical/Chemical Methods, SW-846, Volume II, Third Edition.

## **E. FIGURE**

9a -- Disposable Dip Sampler



**FIGURE 9a -- DISPOSABLE DIP SAMPLER**



# **SECTION X: SEDIMENT SAMPLING**

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# SECTION X: SEDIMENT SAMPLING

## A. REMINDER CHECKLISTS

### 1. Pre-Sampling Activities

- \_\_\_ Establish purpose(s) of sampling.
- \_\_\_ Determine the extent of the sampling effort, the sampling methods to be employed, and which equipment and supplies are required.
- \_\_\_ Assess site hazards and develop and/or review a safety plan.
- \_\_\_ Obtain necessary sampling and monitoring equipment; decontaminate or pre-clean the equipment, and ensure that it is in working order.
- \_\_\_ Bring enough clean water for rinsing, cleaning, and cooling off.
- \_\_\_ Schedule lab time and order bottles two weeks in advance.
- \_\_\_ If necessary, contact owner/operator prior to the trip to schedule the sampling event, to gain access to the site, to discuss the purpose of the sampling event, and to address any safety and security concerns at the site.
- \_\_\_ Be prepared to sample in extreme weather conditions, if applicable.
- \_\_\_ Schedule a meeting prior to the trip to ensure all sampling team members understand their roles and responsibilities.
- \_\_\_ Identify local suppliers of sampling expendables (e.g. ice, plastic bags), and overnight delivery services (e.g. Federal Express), and recharge of SCBA air tanks (local Fire Dept.).
- \_\_\_ Prepare your sample containers prior to sampling (label and organize).

### 2. During Sampling Activities

- \_\_\_ Document the sampling event. At a minimum, include weather conditions, date, time, sampler's name, photographs, any deviations from the original sampling plan, and any problems encountered.

- \_\_\_ Collect samples in order of volatilization. Special care is taken when collecting VOC samples.
- \_\_\_ If necessary, monitor the air in the area where the sampling is taking place so that you can adjust your level of protection.
- \_\_\_ Keep sample bottles in coolers properly preserved, sealed and maintain chain of custody.
- \_\_\_ Never composite VOC samples.
- \_\_\_ Wipe off outside of sample bottles prior to placement in cooler.

### **3. Post-Sampling Activities**

- \_\_\_ Decontaminate all field equipment and PPE if appropriate, in accordance with the Health and Safety Plan. Return all reusable equipment to the IEPA warehouse or its place of origin.
- \_\_\_ Classify all waste generated (i.e. IDW = cuttings, rinse waters, baggies, contaminated PPE) and dispose of properly.
- \_\_\_ Keep samples cool; ship or drop off to appropriate laboratory, in accordance with BOL SOP for Sample Packaging and Shipping.
- \_\_\_ Separate incompatible waste samples so that they are not transported in the same cooler.
- \_\_\_ Seal odorous waste samples in a cooler to avoid breathing vapors or odors during transportation.
- \_\_\_ Transcribe field notes to memorandum form and submit to the Bureau File. Include photographs and a sketch of site with sampling locations clearly identified.

## **B. EQUIPMENT CHECKLIST**

The selection of the sampling devices should be based upon waste properties (e.g. liquid or solid), site factors (e.g. waste accessibility, waste generation practices, and degree of hazard), and the analytes to be quantitated (e.g. VOCs or heavy metals). Ease of use under the site conditions and the degree of hazard associated with using a given device should also be considered. See attached sampling equipment checklist for a list of the equipment used for sampling sediment.

## SAMPLING EQUIPMENT CHECKLIST

### PAPERWORK:

- ☐ IEPA Identification
- ☐ Safety Training Certification
- ☐ Lab Phone Numbers
- ☐ Site Map & Directions
- ☐ Chemical Analysis Forms
- ☐ Chain of Custody Forms
- ☐ Receipt for Samples (RCRA sites only)
- ☐ Field Log Forms or Field Log Book
- ☐ Site Safety Plan

### PROJECT MANAGER:

- ☐ Field Logbook
- ☐ Agency Phone Book
- ☐ Aluminum Case (for paperwork)
- ☐ Calculator
- ☐ Camera
- ☐ Camera Batteries
- ☐ Extra Film
- ☐ Pencils & Pens (Waterproof)
- ☐ China Markers
- ☐ Compass
- ☐ Pocket Knife
- ☐ Emergency Raingear
- ☐ Paper Towels
- ☐ PPE Gloves ☐ L ☐ XL
- ☐ pH Paper
- ☐ Decon Spray Bottles:
  - ☐ Liquinox Solution
  - ☐ Deionized/Distilled Water

### GENERAL SAMPLING EQUIPMENT:

- ☐ Sample Bottles
- ☐ Extra Bottle Labels
- ☐ Waterproof Clear Tape
- ☐ Visqueen (pre-cut)
- ☐ Utility Knife or Pocket Knife
- ☐ Portable Table
- ☐ Garbage Bags
- ☐ Rain Canopy & Poles
- ☐ Nylon Rope
- ☐ Water Carriers
- ☐ Paper Towels
- ☐ Duct Tape
- ☐ Masking Tape
- ☐ Flashlights & Batteries
- ☐ Binoculars
- ☐ Aluminum Foil
- ☐ Shovel
- ☐ Trowel/Sampling Spoons
- ☐ Machete

### FOR DECON:

- Spray Bottles:
  - ☐ Liquinox Solution
  - ☐ Distilled/Deionized Water
- 1/2-Gallon Jugs:
  - ☐ HCL; dilute to 5 or 10%
  - ☐ Liquinox Solution
  - ☐ DI Water
- 5-Gallon Sprayers:
  - ☐ Liquinox Solution
  - ☐ Tap Water
  - ☐ Extra Gallons of DI Water
- ☐ Paper Towels
- ☐ Aluminum Foil
- ☐ Brushes
- ☐ Plastic Tubs
- ☐ 5-Gallon Plastic Buckets
- ☐ Garbage Bags

### FOR FIELD MEASUREMENTS:

- ☐ Passport
- ☐ PID
- ☐ FID
- ☐ TVA
- ☐ pH/Temp/Millivolt Meter
  - ☐ Battery; 9-volt
- ☐ pH Buffers; 4, 7, & 10
- ☐ Radiation Detector
- ☐ Draeger Pump, Tubes

### PPE, SAFETY & SUPPORT:

- ☐ Cleaning & Cooling Water
- ☐ Drinking Water
- ☐ Gatorade
- ☐ Ice for Drinking Water
- ☐ Hand Soap/Goop
- ☐ First Aid Kit
- ☐ Insect/Tick Repellant
- ☐ Sunscreen
- ☐ Fire Extinguishers
- ☐ Walkie Talkies
- ☐ Full-Face Respirators
- ☐ Cartridges
- ☐ SCBAs
- ☐ Cylinders
- ☐ Safety Glasses
- ☐ Disposable Booties
- ☐ Tyvek
- ☐ Saranex
- ☐ Raingear
- ☐ Cotton Coveralls
- ☐ Insulated Coveralls
- ☐ Steel-Toed/Shanked Boots
- ☐ Insulated Pack-Boots

### SEALING & TRANSPORTATION

- ☐ Coolers
- ☐ Blue Ice
- ☐ Dry Ice
- ☐ Regular Ice
- ☐ Large Liners for Coolers
- ☐ 1-Gallon Ziplock Bags
- ☐ Quart Ziplock Bags
- ☐ Tie Wraps
- ☐ Large FDA Cooler Bags
- ☐ Evidence Tape
- ☐ Strapping Tape
- ☐ Vermiculite

### SEDIMENT SAMPLING EQUIPMENT

- ☐ Trowel or Scoop
- ☐ Thin-Wall Tube Auger(s)\*
- ☐ Ekman Dredge
- ☐ Ponar Dredge
- ☐ Coring Device
- ☐ Bailer Cord
- ☐ Chem Wipes

\* Including handles

## **C. PROCEDURES**

- 1. Trowel or Scoop - Surface Sediment Sampling Beneath a Shallow Aqueous Layer (Figure 10a).**
  - a. Be certain the trowel or scoop has been decontaminated prior to use.
  - b. Remove any debris on the bed of the stream or other water body with such tools as a spade, shovel to prepare the surface sediment for sampling, being careful to minimize disturbance of the water and sediment.
  - c. Using a stainless steel or plastic trowel or scoop, collect a sufficient quantity of surface sediment to provide a representative sample.
  - d. Collect the first sample for VOC analysis directly from the sampler and transfer to the appropriate sample container(s).
  - e. When analyses are required for parameters other than VOCs, mix the remainder of the collected sediment to obtain a homogeneous sample, then transfer to the appropriate sample container(s).
  - f. Return the unused portion of the sample to the sampling point.
  - g. Transfer the sample container(s) to a chilled cooler and prepare for shipping.
  
- 2. Thin-Wall Tube Augers - Surface Sediment Sampling Beneath a Shallow Aqueous Layer (Figure 10b).**
  - a. An acetate core may be inserted into the auger prior to sampling, if characteristics of the sediments or body water warrant. By using this technique, an intact core can be extracted.
  - b. Insert the auger into the material at a 0° to 45° angle to minimize spillage of the sample. Extraction of samples may require tilting the sampler.
  - c. Rotate the auger once or twice to cut a core of material.
  - d. Slowly withdraw the auger, making sure that the slot is facing upward.
  - e. Collect the first sample for VOC analysis directly from the auger and transfer to the appropriate sample container(s).

- f. When analyses are required for parameters other than VOCs, mix the remainder of the collected sediment to obtain a homogeneous sample, then transfer to the appropriate sample container(s).
- g. Return the unused portion of the sample to the sampling point.
- h. Transfer the sample container(s) to a chilled cooler and prepare for shipping.

**3. Augers and Thin-Wall Tube Samplers - Deep Sediment Sampling Beneath a Shallow Aqueous Layer (Figure 10b).**

- a. Attach the auger bit to an extension rod, then attach the "T" handle to the extension rod.
- b. Clear the area to be sampled of any surface debris using a spade or shovel being careful to minimize the disturbance of the water and bed of the water body.
- c. Begin auguring, periodically removing any accumulated sediment from the auger.
- d. After reaching the desired depth, slowly and carefully remove the auger from the boring. When sampling directly from the auger, collect the sample after the auger is removed from the boring and proceed to step (i).
- e. Remove the auger tip from extension rods and replace with a pre-cleaned thin-wall tube sampler with the proper cutting tip.
- f. Carefully lower the tube sampler down the borehole, being careful to not scrap the borehole sides, and gradually force the tube sampler into the sediment. **DO NOT HAMMER THE EXTENSION RODS TO FACILITATE CORING SINCE THE VIBRATIONS MAY CAUSE THE BORING WALLS TO COLLAPSE.**
- g. Remove the tube sampler and unscrew the extension rods.
- h. Remove the cutting tip and core from the device.
- i. Discard the top of the core (approximately one (1) inch), up-hole material collected by the tube sampler prior to reaching the collection point.



- j. Collect the first sample for VOC analysis directly from the sampler and transfer to the appropriate sample container(s).
- k. When analyses are required for parameters other than VOCs, mix the remainder of the collected sediment to obtain a homogeneous sample, then transfer to the appropriate sample container(s).
- l. Return the unused portion of the sample to the sampling point.
- m. Transfer the sample container(s) to a chilled cooler and prepare for shipping.

**4. Ekman Dredge - Sediment Sampling from Beneath a Deep Aqueous Layer (Figure 10c).**

- a. Thread a sturdy nylon rope or stainless steel cable through the bracket of an Ekman dredge, or secure the extended handle to the bracket with machine bolts.
- b. Attach springs to both sides. Arrange the Ekman dredge sampler so that the jaws are in the open position and trip cables are positioned over the release studs.
- c. Lower the sampler to just above the sediment surface.
- d. Drop the sampler sharply onto the sediment.
- e. Trigger the jaw release mechanism by lowering a messenger down the line, or by depressing the button on the upper end of the extended handle.
- f. Raise the sampler and slowly decant any free liquid through the top of the sampler over the sampling point, being careful to retain the sediments.
- g. Open the dredge and transfer sediments to a stainless steel or plastic bucket. Continue to collect additional sediment until sufficient material has been accumulated.
- h. Collect the first sample for VOC analysis directly from the sampler and transfer to the appropriate sample container(s).
- i. When analyses are required for parameters other than VOCs, mix the remainder of the collected sediment to obtain a homogeneous sample, and then transfer to the appropriate sample container(s).

- j. Return the unused portion of the sample to the sampling point.
- k. Transfer the sample container(s) to a chilled cooler and prepare for shipping.

**5. Ponar Dredge - Sediment Sampling from Beneath a Deep Aqueous Layer (Figure 10d).**

- a. Attach a sturdy nylon rope or stainless steel cable to the hook provided on the top of the dredge.
- b. Arrange the Ponar dredge sampler in the open position, setting the trip bar so the sampler remains open when lifted from the top.
- c. Slowly lower the sampler to just above the sediment.
- d. Drop the sampler sharply into the sediment, then pull sharply up on the line, thus releasing the trip bar and closing the dredge.
- e. Raise the sampler to the surface and slowly decant any free liquid through the screens on top of the dredge being careful to retain sediments.
- f. Open the dredge and transfer the sediment to a stainless steel or plastic bucket. Continue to collect additional sediment until sufficient material has been accumulated.
- g. Collect the first sample for VOC analysis directly from the sampler and transfer to an appropriate sample container(s).
- h. When analyses are required for parameters other than VOCs, mix the remainder of the collected sediment to obtain a homogeneous sample, then transfer to an appropriate sample container(s).
- i. Return the unused portion of the sample to the sampling point.
- j. Transfer the sample container(s) to a chilled cooler and prepare for shipping.

**6. Coring Device - Sediment Sampling from Beneath a Deep Aqueous Layer (Figure 10e).**

- a. Assemble the coring device by inserting the acetate core into the sampling tube.

- b. Insert the "eggshell" check valve mechanisms into the tip of the sampling tube with the convex surface positioned inside the acetate core.
- c. Screw the coring point onto the tip of the sampling tube.
- d. Screw the handle onto the upper end of the sampling tube and add extension rods as needed.
- e. Place the sampler in a perpendicular position to the material to be sampled.
- f. If using the "T" handle, place downward pressure on the device until the desired depth is reached. Then rotate the sampler to shear off the core of the bottom, retrieve the device and proceed to Step (o) below.
- g. If the drive hammer is selected for consolidated sediments, insert the tapered handle of the drive hammer through the drive head.
- h. With the left hand holding the tube, drive the sampler into the material to the desired depth being careful to not drive the tube further than the tip of the hammer's guide.
- i. Record the length of the tube that penetrated the sample material, and the number of blows required to obtain the depth.
- j. Remove the drive hammer and fit the keyhole-like opening on the flat side of the hammer onto the drive head. In this position, the hammer serves as a handle for the sampler.
- k. Rotate the sampler at least two (2) revolutions to shear off the sample at the bottom.
- l. Lower the sampler handle (hammer) until it just clears the two (2) ear-like protrusions on the drive head, and rotate about 90°.
- m. Withdraw the sampler by pulling the handle (hammer) upwards and dislodging the hammer from the sampler.
- n. Unscrew the coring point and remove the "eggshell" check valve.
- o. Slide the acetate core out of the sampler tube. The acetate core may be capped at both ends. Collect the first sample for VOC analysis directly from the sampler and transfer to the appropriate sample container(s).
- p. When analyses are required for parameters other than VOC's, transfer the

remainder of the sample to a stainless steel or plastic bucket and mix to obtain a homogeneous sample, then transfer to the appropriate sample container(s).

- q. Return the unused portion of the sample to the sampling point.
- r. Transfer the sample container(s) to a chilled cooler and prepare for shipping.

## **D. REFERENCES**

Reproduced in part from OSWER Directive 9360.4-03, January 1991.

## **E. FIGURES**

10a -- Trowel (Scoop)

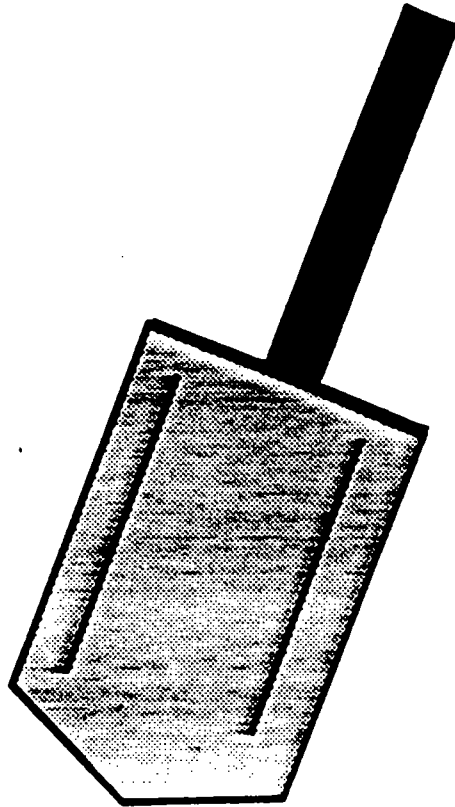
10b -- Thin-Wall Tube and Bucket Augers

10c -- Ekman Dredge

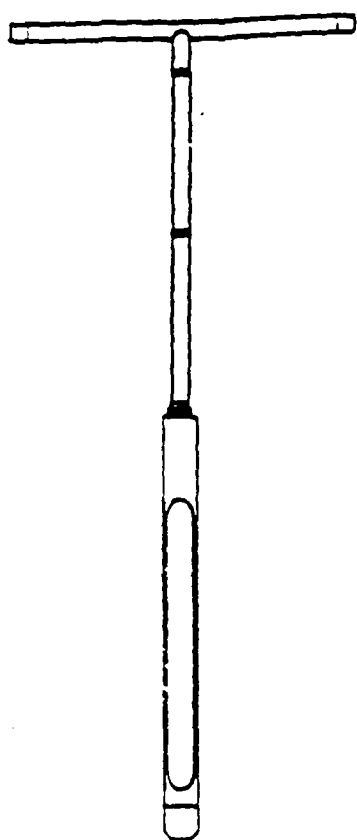
10d -- Ponar Dredge

10e -- Coring Device Sampler

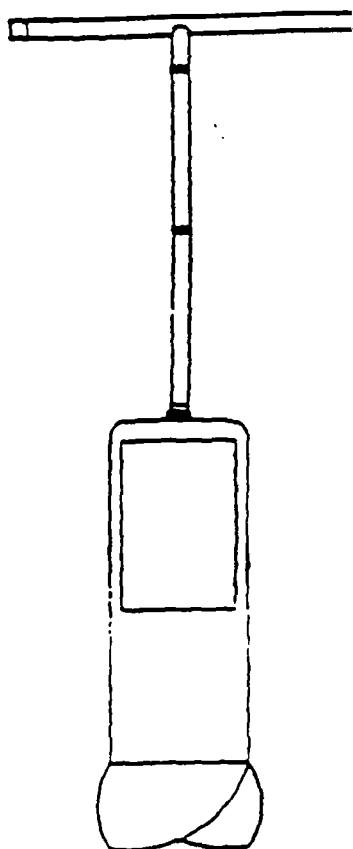
**FIGURE 10a – TROWEL (SCOOP)**



**FIGURE 10b – AUGER SAMPLERS**

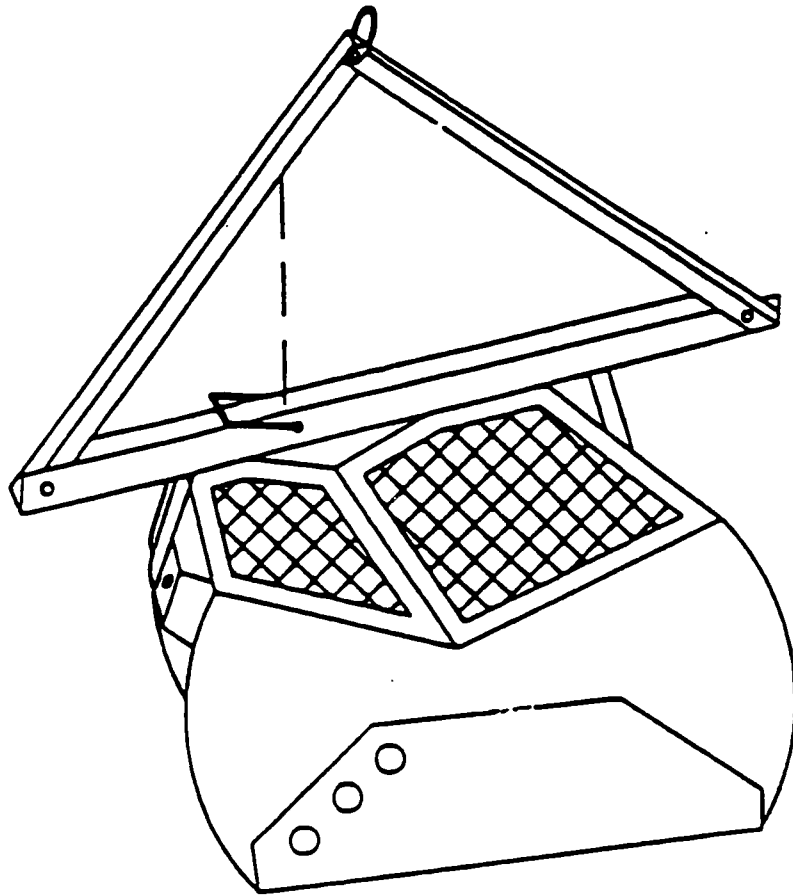


TUBE  
AUGER

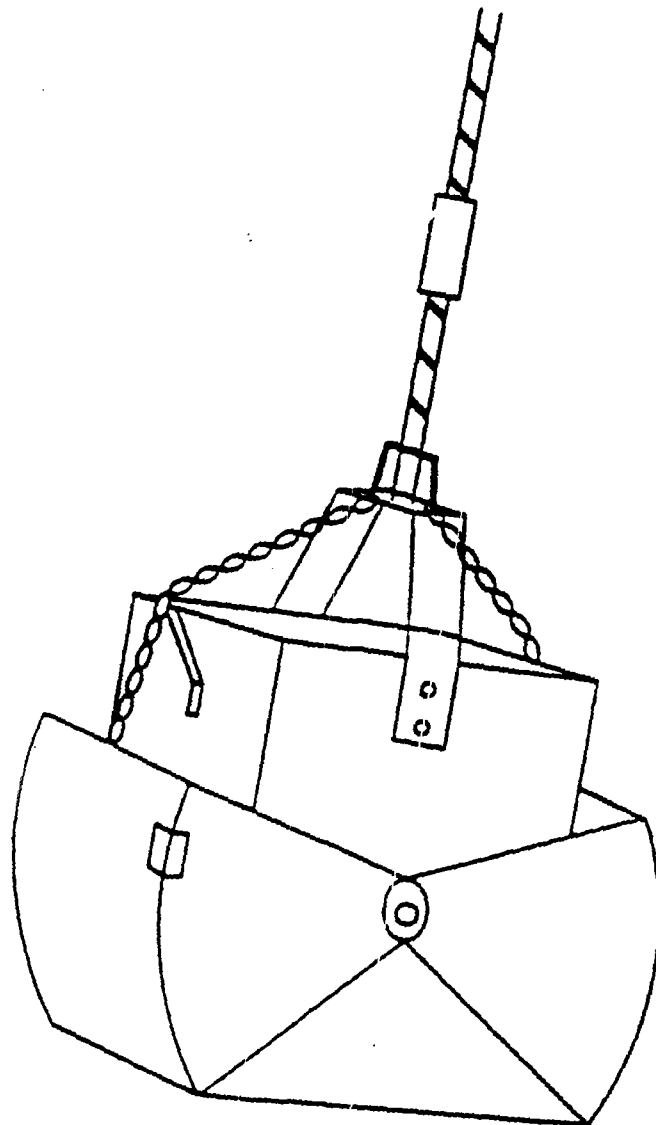


BUCKET  
AUGER

**FIGURE 10c – EKMAN DREDGE**



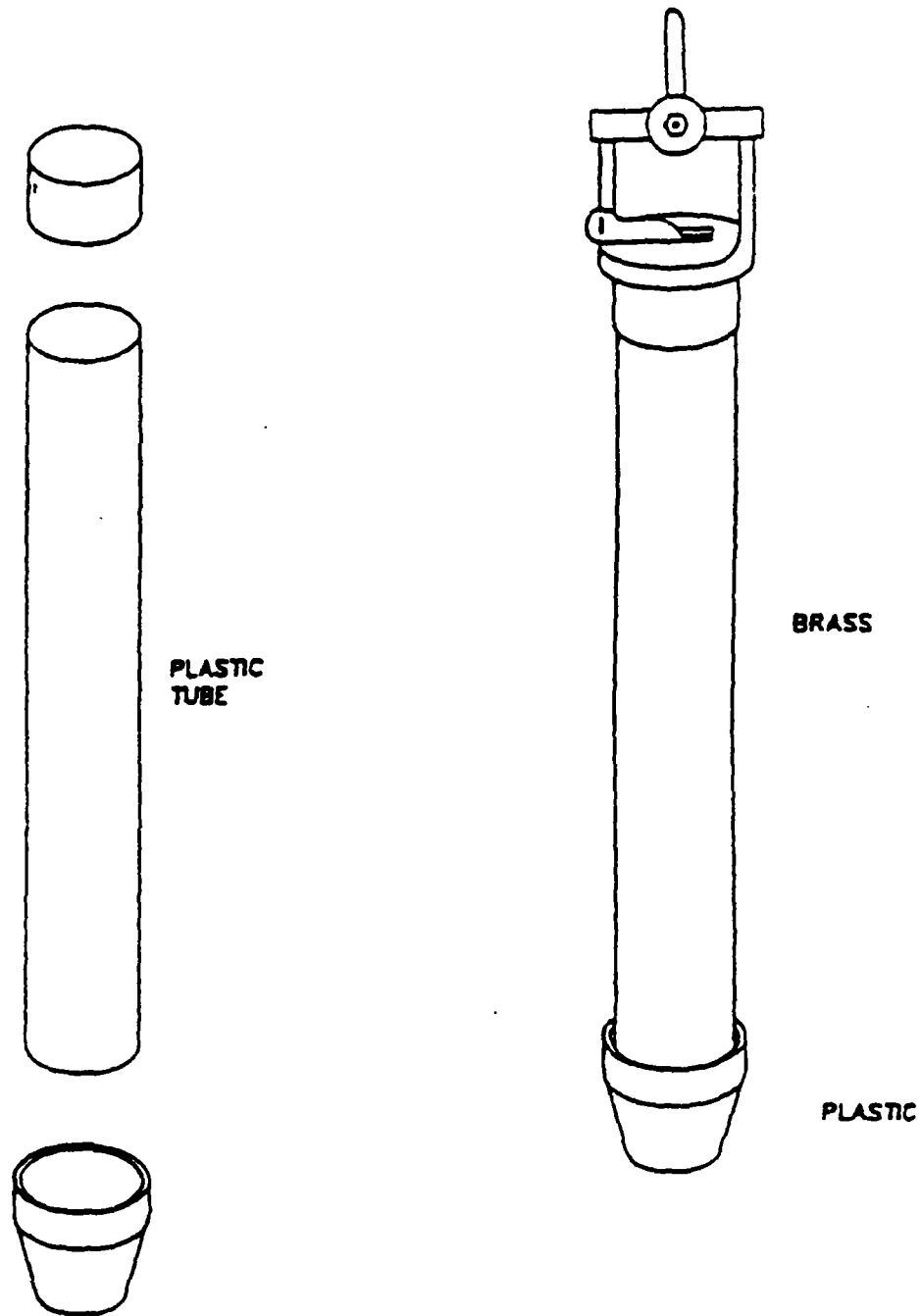
**FIGURE 10d -- PONAR DREDGE**



September 1996



**FIGURE 10e – CORING DEVICE SAMPLER**



# **SECTION XI: LEACHATE SAMPLING**

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## SECTION XI: LEACHATE SAMPLING

### A. REMINDER CHECKLISTS

#### 1. Pre-Sampling Activities

- \_\_\_ Assess site hazards and develop and/or review a safety plan.
- \_\_\_ Develop and/or review a sampling plan.
- \_\_\_ Establish purpose(s) of sampling.
- \_\_\_ Obtain necessary sampling and monitoring equipment: decontaminate or preclean the equipment, and ensure that it is in working order.
- \_\_\_ Bring enough clean water for rinsing, cleaning, and cooling off.
- \_\_\_ Schedule lab time and order your bottles 2 weeks in advance.
- \_\_\_ Be prepared to sample in extreme weather conditions, if applicable.
- \_\_\_ Schedule a meeting prior to the trip to ensure all sampling team members understand their role and responsibilities.
- \_\_\_ If necessary, contact owner/operator prior to the trip to schedule the sampling event, to gain access to the site, to discuss the purpose of the sampling event, and to address any safety and security concerns at the site.
- \_\_\_ Identify local suppliers of sampling expendables (e.g., ice, plastic bags) and overnight delivery services (e.g., Federal Express), and recharge of SCBA air tanks (local Fire Dept.).
- \_\_\_ Become familiar with the impoundment, such as where the waste enters the unit, where the waste exits the unit (if applicable), and accessibility to the unit.
- \_\_\_ If sludge samples are required, refer to Section X of this document for additional guidance.
- \_\_\_ Prepare your sample containers prior to sampling (label and organize).

## **2. During Sampling Activities**

- \_\_\_ Document the sampling event. At a minimum, include weather conditions, date, time, sampler's name, photographs, any deviations from the original sampling plan, and any problems encountered.
- \_\_\_ Collect samples in order of volatilization. Special care is taken when collecting VOC samples.
- \_\_\_ If necessary, monitor the air in the area where sampling is taking place so that you can adjust your level of protection.
- \_\_\_ Keep sample bottles in coolers properly preserved, sealed and maintain chain of custody.
- \_\_\_ Never composite VOC samples.
- \_\_\_ Wipe off outside of sample bottles prior to placement in cooler.
- \_\_\_ Sample bottles with preservatives cannot be overfilled (liquid samples).
- \_\_\_ Photograph sample containers at sample location.

## **3. Post-Sampling Activities**

- \_\_\_ Decontaminate all field equipment and PPE, if appropriate, in accordance with the Health and Safety Plan. Return all reusable equipment to the IEPA warehouse or its place of origin.
- \_\_\_ Classify all waste generated (i.e., IDW = cuttings, rinse waters, baggies, contaminated PPE) and dispose of properly.
- \_\_\_ Keep samples cool; ship or drop off to appropriate laboratory, in accordance with BOL SOP for Sampling Packaging and Shipping.
- \_\_\_ Separate incompatible wastes so that they are not transported in the same cooler.
- \_\_\_ Seal odorous wastes in the cooler to avoid breathing vapors or odors during transportation.
- \_\_\_ Make sure water reactive wastes are not transported with water or ice.

## **B. EQUIPMENT CHECKLIST**

The selection of the sampling devices should be based upon waste properties (e.g., liquid or solid), site factors (e.g., waste accessibility, waste generation practices, and degree of hazard), and the analytes to be quantitated (e.g., VOCs or heavy metals). Ease of use under the site conditions and the degree of hazard associated with using a given device should also be considered. Refer to following table to determine equipment needs.

**SAMPLING EQUIPMENT CHECKLIST:**  
**LEACHATES**

**PAPERWORK:**

- ☐ IEPA Identification
- ☐ Safety Training Certification
- ☐ Lab Phone Numbers
- ☐ Site Map & Directions
- ☐ Chemical Analysis Forms
- ☐ Chain of Custody Forms
- ☐ Receipt for Samples (RCRA sites only)
- ☐ Field Log Forms or Field Log Book

**PROJECT MANAGER:**

- ☐ Field Logbook
- ☐ Aluminum Case (for paperwork)
- ☐ Calculator
- ☐ Camera
- ☐ Camera Battery
- ☐ Pencils & Pens
- ☐ China Markers
- ☐ Compass
- ☐ Pocket Knife
- ☐ Emergency Raingear
- ☐ Paper Towels
- ☐ PPE Gloves ☐ L ☐ XL
- ☐ pH Paper
- ☐ Decon Spray Bottles:
  - ☐ Liquinox Solution
  - ☐ Deionized/Distilled Water

**GENERAL SAMPLING EQUIPMENT:**

- ☐ Sample Bottles
- ☐ Clean Glass Tubes
- ☐ Extra Sample Bottles
- ☐ Extra Bottle Labels
- ☐ Waterproof Clear Tape
- ☐ Visqueen (pre-cut)
- ☐ Utility Knife or Pocket Knife
- ☐ Portable Table
- ☐ Garbage Bags
- ☐ Rain Canopy & Poles
- ☐ Nylon Rope
- ☐ Water Carriers
- ☐ Paper Towels
- ☐ Duct Tape
- ☐ Masking Tape
- ☐ Flashlights & Batteries
- ☐ Binoculars
- ☐ Aluminum Foil
- ☐ Shovel

**FOR DECON:**

- Spray Bottles:**
  - ☐ Liquinox Solution
  - ☐ Distilled/Deionized Water
- 1/2-Gallon Jugs:**
  - ☐ HCL; dilute to 5 or 10%
  - ☐ Liquinox Solution
  - ☐ DI Water
- 5-Gallon Sprayers:**
  - ☐ Liquinox Solution
  - ☐ Tap Water
  - ☐ Extra Gallons of DI Water
- ☐ Paper Towels
- ☐ Aluminum Foil
- ☐ Brushes
- ☐ Plastic Tubs
- ☐ 5-Gallon Plastic Buckets
- ☐ Garbage Bags

**FOR FIELD MEASUREMENTS:**

- ☐ Passport
- ☐ PID
- ☐ FID
- ☐ TVA
- ☐ pH/Temp/Millivolt Meter
- ☐ Battery; 9-volt
- ☐ pH Buffers; 4, 7, & 10
- ☐ Radiation Detector
- ☐ Draeger Pump, Tubes

**PPE, SAFETY & SUPPORT:**

- ☐ Cleaning & Cooling Water
- ☐ Drinking Water
- ☐ Gatorade
- ☐ Ice for Drinking Water
- ☐ Hand Soap/Goop
- ☐ First Aid Kit
- ☐ Insect/Tick Repellant
- ☐ Sunscreen
- ☐ Fire Extinguishers
- ☐ Walkie Talkies
- ☐ Full-Face Respirators
- ☐ Cartridges
- ☐ SCBAs
- ☐ Cylinders
- ☐ Field Chairs
- ☐ Disposable Booties
- ☐ Tyvek
- ☐ Saranex
- ☐ Raingear

**SEALING & TRANSPORTATION**

- ☐ Coolers
- ☐ Blue Ice
- ☐ Dry Ice
- ☐ Regular Ice
- ☐ Large Liners for Coolers
- ☐ 1-Gallon Ziplock Bags
- ☐ Quart Ziplock Bags
- ☐ Large FDA Cooler Bags
- ☐ Evidence Tape
- ☐ Strapping Tape

**SPECIFIC SAMPLING**

**EQUIPMENT:**

Refer to the appropriate Sampling Equipment Checklist referenced.

## **C. PROCEDURES**

Collection of leachate samples may involve the collection of liquid, sediment, sludge, or soil samples, depending on where the leachate is found. For instance, if leachate migrates from its source, it could come in contact with soil or with a stream. When sampling leachate, it is very important to document the source of the leachate and its flow paths, surrounding surface drainage patterns, and locations and flow direction of streams and intermittent streams. This information is needed to interpret and compare analytical results to appropriate water quality standards. Document the samples with photos and a well-drawn site map with sample locations, leachate flow paths and surface drainage patterns.

Take extra safety precautions when filling sample bottles that contain preservatives. Violent reactions could occur between the leachate and the preservative. Consider using unpreserved VOC bottles to avoid loss of volatiles. If unpreserved bottles are used, inform the lab and make a notation on the sampling paperwork. For leachates that react with the HCL preservative, use a vial without the HCL preservative and label it with the words "NOT ACIDIFIED." The lab will then run the sample more quickly to comply with the shorter holding time for unpreserved VOC samples. A sample of a vial can be seen on Figure 11a. Make sure appropriate protective gear is worn and all necessary safety precautions are taken prior to collecting samples.

### **1. Liquid Sampling**

Refer to Sections IV (Surface Impoundments) and IX (Surface Water) for the appropriate sampling technique. The sample collector might consider compositing leachate samples if he/she is trying to evaluate compliance with 35 IAC, Part 304 effluent standards (see Section 304.104).

### **2. Sediment Sampling**

Refer to Section X (Sediments).

### **3. Sludge Sampling**

Refer to Section X (Sediments).

### **4. Soil Sampling**

Refer to Section VI (Surface and Subsurface Soils).

## D. REFERENCES

Illinois Environmental Protection Agency, Remedial Project Management Section.  
Methods & Procedures Manual for Activities Undertaken Under the Preliminary  
Assessment/Site Inspection Program, 1987.



## **SECTION XII: SAMPLING FOR LEAD-BASED PAINT CHIPS AND DUST**

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## **SECTION XII: SAMPLING FOR LEAD-BASED PAINT CHIPS AND DUST**

The following procedures are recommended for the investigation of complaints related to the uncontrolled removal of lead-based paint from exterior surfaces such as water towers, bridges, homes, and commercial buildings. If further guidance is needed, please contact Connie Sullinger with the Office of Chemical Safety at 217-785-0830.

### **A. REMINDER CHECKLIST**

#### **1. Pre-Sampling Activities**

- \_\_\_ Review the site safety plan (SSP) if one exists. If a SSP is not available, assess site hazards and develop a SSP. A computer program has been developed to help generate a SSP and is available from the Health and Safety Unit. Alternatively, a generic, fill-in-the-blanks, SSP is provided in Section XV.
- \_\_\_ Establish purpose(s) of sampling.
- \_\_\_ Obtain necessary sampling and monitoring equipment; decontaminate or pre-clean the equipment, and ensure that it is in working order.
- \_\_\_ Bring enough clean water for rinsing, cleaning and cooling off.
- \_\_\_ Schedule lab time and order your bottles 2 weeks in advance.
- \_\_\_ Be prepared to sample in extreme weather conditions, if applicable.
- \_\_\_ Schedule a meeting prior to the trip to ensure all sampling team members understand their role and responsibilities.
- \_\_\_ If necessary, contact owner/operator prior to the trip to schedule the sampling event to gain access to the site, to discuss the purpose of the sampling event, and to address any safety and security concerns at the site.
- \_\_\_ Identify local suppliers of sampling expendables (e.g., ice, plastic bags) and overnight delivery services (e.g., Federal Express), and recharge of SCBA air tanks (local Fire Department).
- \_\_\_ If possible, arrange to have the complainant or another informed

individual available to identify the areas of contamination. Removal methods such as sanding or abrasive removal create fine dust that may not be obvious to the eye once deposited onto horizontal surfaces. An eyewitness can make the gathering of samples easier and more accurate.

- High priority should be given those sites that involve potential exposure to children six and under and pregnant women.
- If the removal involves a single family, multi-family residence, or day care center, contact the Illinois Department of Public Health contact person listed on Attachment A. For complaints in Cook County, contact Cheryl Walls with the Cook County Department of Public Health at 708-445-2530. For complaints in the City of Chicago, contact Cato Kirksey with the City of Chicago Department of Health at 312-746-6589. Conducting the removal of lead-based paint from residential structures and daycare facilities in a manner not allowed by the Illinois Department of Public Health is a violation of the Lead Poisoning Prevention Act.
- Prepare your sample containers prior to sampling (label and organize).

## **2. During Sampling Activities**

- Document the sampling event. At a minimum, include weather conditions, date, time, sampler's name, photographs, any deviations from the original sampling plan, and any problems encountered.
- If necessary, monitor the air in the area where sampling is taking place so that you can adjust your level of protection.

## **3. Post-Sampling Activities**

- Decontaminate all field equipment and PPE if appropriate, in accordance with the Health and Safety Plan. Return all reusable equipment to the IEPA warehouse or its place of origin.
- Classify all waste generated (i.e., IDW = cuttings, rinse waters, baggies, contaminated PPE) and dispose of properly.

## B. EQUIPMENT CHECKLIST

- Soil sample bottles and trowels should be taken to the site for the collection of waste residues, leaded dust, and potentially contaminated soil.
- Disposable wipes—The following wipe media have been found to be sufficiently durable under field use and have demonstrated acceptable recovery rates (80-120%): "Little Ones Baby Wash Cloths™", "Little Ones Baby Wipes Natural Formula™", Little Ones Baby Wipes Lightly Scented™, "Pure and Gentle Baby Wipes™", "Fame Baby Wipes™", and individually-packaged "Wash'n Dri Wipes™". Wipes should not contain aloe.
- Disposable gloves in order to prevent cross-sample contamination from hands. (Latex surgical gloves are acceptable for this type of sampling.)
- Template Options
  - a. Masking tape can be used to define the area to be wiped. If using masking tape, take along a measuring tape in order to define the area sampled.
  - b. Disposable templates can be used, especially for floors, and are typically 1 ft<sup>2</sup>. Templates are usually not used for windows due to the variability in size and shape.

## SAMPLING EQUIPMENT CHECKLIST

### PAPERWORK:

- ☐ IEPA Identification
- ☐ Safety Training Certification
- ☐ Lab Phone Numbers
- ☐ Site Map & Directions
- ☐ Chemical Analysis Forms
- ☐ Chain of Custody Forms
- ☐ Receipt for Samples (RCRA sites only)
- ☐ Field Log Forms or Field Log Book

### PROJECT MANAGER:

- ☐ Field Logbook
- ☐ Aluminum Case (for paperwork)
- ☐ Calculator
- ☐ Camera/Battery/Film
- ☐ Disposable Wipes
- ☐ Pencils & Pens
- ☐ Measuring Tape
- ☐ Disposable Template
- ☐ China Markers
- ☐ Compass
- ☐ Pocket Knife
- ☐ Emergency Raingear
- ☐ Paper Towels
- ☐ PPE Gloves ☐ L ☐ XL
- ☐ pH Paper
- ☐ Decon Spray Bottles:
  - ☐ Liquinox Solution
  - ☐ Deionized/Distilled Water

### GENERAL SAMPLING EQUIPMENT:

- ☐ Sample Bottles
- ☐ Extra Bottle Labels
- ☐ Waterproof Clear Tape
- ☐ Visqueen (pre-cut)
- ☐ Utility Knife or Pocket Knife
- ☐ Portable Table
- ☐ Garbage Bags
- ☐ Rain Canopy & Poles
- ☐ Nylon Rope
- ☐ Water Carriers
- ☐ Paper Towels
- ☐ Duct Tape
- ☐ Masking Tape
- ☐ Flashlights & Batteries
- ☐ Binoculars
- ☐ Aluminum Foil
- ☐ Shovel
- ☐ Trowel/Sampling Spoons
- ☐ Machete

### FOR DECON:

- ☐ Spray Bottles:
  - ☐ Liquinox Solution
  - ☐ Distilled/Deionized Water
- ☐ 1/2-Gallon Jugs:
  - ☐ HCL; dilute to 5 or 10%
  - ☐ Liquinox Solution
  - ☐ DI Water
- ☐ 5-Gallon Sprayers:
  - ☐ Liquinox Solution
  - ☐ Tap Water
  - ☐ Extra Gallons of DI Water
- ☐ Paper Towels
- ☐ Aluminum Foil
- ☐ Brushes
- ☐ Plastic Tubs
- ☐ 5-Gallon Plastic Buckets
- ☐ Garbage Bags

### FOR FIELD MEASUREMENTS:

- ☐ Passport
- ☐ PID
- ☐ FID
- ☐ pH/Temp/Millivolt Meter
- ☐ Battery; 9-volt
- ☐ pH Buffers; 4, 7, & 10
- ☐ Radiation Detector
- ☐ Draeger Pump, Tubes

### PPE, SAFETY & SUPPORT:

- ☐ Cleaning & Cooling Water
- ☐ Drinking Water
- ☐ Gatorade
- ☐ Ice for Drinking Water
- ☐ Hand Soap/Goop
- ☐ First Aid Kit
- ☐ Insect/Tick Repellant
- ☐ Sunscreen
- ☐ Fire Extinguishers
- ☐ Walkie Talkies
- ☐ Full-Face Respirators
- ☐ Cartridges
- ☐ SCBAs
- ☐ Cylinders
- ☐ Field Chairs
- ☐ Disposable Booties
- ☐ Tyvek
- ☐ Saranex
- ☐ Raingear
- ☐ Cotton Coveralls
- ☐ Insulated Coveralls
- ☐ Steel-Toed/Shanked Boots
- ☐ Insulated Pack-Boots
- ☐ Hardhat/Face Shields
- ☐ Nitrile/Butyl Rubber/Neoprene Gloves
- ☐ Glove Liners

### SEALING & TRANSPORTATION

- ☐ Coolers
- ☐ Blue Ice
- ☐ Dry Ice
- ☐ Regular Ice
- ☐ Large Liners for Coolers
- ☐ 1-Gallon Ziplock Bags
- ☐ Quart Ziplock Bags
- ☐ Large FDA Cooler Bags
- ☐ Evidence Tape
- ☐ Strapping Tape

## C. SAMPLING PROCEDURES

### 1. Sampling Soil for Waste Residue (Chips and Dust)

- a. The scraping of lead-based paint generates chips and dust that are found within a few feet of the building. Check to see if paint chips are present. Examine grass and soil carefully for contamination. Chips and dust can quickly filter through grass and loose soil and therefore may not be apparent without close inspection.
- b. Soil samples should be taken within the top few inches of soil. Make drawings of sample locations relative to the source area.
- c. Take a sample of the lead-based paint waste residue. If possible, take enough sample (at least 100 grams or 4 oz. by weight) so that a Toxicity Characteristic Leaching Procedure (TCLP) for waste characterization can be run **if needed**.
- d. Samples should be obtained of potentially impacted off-site areas to indicate dispersion of the lead from the source area. Focus on children's play areas, gardens and areas of bare soil.
- e. Lead paint dust can be present but invisible. If wipe samples are necessary, take samples in locations most likely impacted by the deposition of leaded dust from the removal operation.
- f. If the age of the housing leads you to suspect the presence of lead-based paint and target populations (children 0-6 years and pregnant women) are present, the laboratory turn-around time should be seven days. Contact OCS for arrangements.
- g. Soil and wipe samples should be analyzed for **TOTAL lead**. If a waste classification is needed, the waste residue samples should be analyzed for **TCLP extractable lead**.
- h. Take pictures of the site and potential contamination.
- i. A copy of the analytical results should be sent to Connie Sullinger in the Office of Chemical Safety, #28.
- j. The approximate age of the housing should be noted due to the fact that lead-based paint was banned from use in residential exterior and interior household paint in 1978. The highest concentrations of lead, up to 50%,

can be found in those paints marketed and used before the 1940s.

## 2. Wipe Sampling for Settled Lead Dust

### a. Outline Wipe Area

1. Floors--apply masking tape to area of about 1 ft<sup>2</sup> or use disposable template. The masking tape should be positioned in a straight line and corners should be nominally perpendicular. Avoid touching the area to be wiped while putting tape or template in place.
2. Window sills or other rectangular surfaces--Apply two strips of masking tape across the sill to define a wipe area at least 0.1 ft<sup>2</sup> in size (approximately 4 inches x 4 inches).
3. For irregular surfaces, it will not be possible to do this. Instead, it will be necessary to measure the area sampled following the procedures in d.

### b. Obtain disposable wipe--When using a container that dispenses wipes through a pop-up lid, dispose of the first wipe in the dispenser. Rotate the container before starting to ensure liquid inside the container contacts all of the wipes.

### c. Conduct wipe sampling

1. Place the wipe at one corner of the surface to be wiped with wipe fully opened and flat on the surface.
2. With the fingers together, grasp the wipe between the thumb and the palm. Press down firmly, but not excessively with both the palm and fingers (do not use the heel of the hand). For square areas, wipe **side-to-side** with as many "S"-like motions as are necessary to completely cover the entire wipe area. Exerting excessive pressure on the wipe will cause it to curl. Exerting too little pressure will result in poor collection of dust. Attempt to remove all visible dust from the wipe area.

Fold the wipe in half with the contaminated side facing inward. Once folded, place in the top corner of the wipe area. Repeat wiping the area with "S"-like motions, but move in a **top-to-bottom** direction. When finished, fold the wipe with the contaminated side facing inward and place wipe in sampling

container.

For rectangular areas such as window sills, two side-to-side passes must be made, the second pass with the wipe folded so that the contaminated side faces inward. It is not necessary to wipe the entire window but do not wipe less than 0.1 ft<sup>2</sup> (approximately 4 inches x 4 inches).

- d. After sampling, measure the surface area wiped to the nearest eighth of an inch. The size of the area wiped must be at least 0.1 ft<sup>2</sup> in order to obtain an adequate limit of quantitation.
- e. Wipe samples should be analyzed for **TOTAL lead**.

## D. REFERENCES

United States Department of Housing and Urban Development. Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing., June 1995.

See Also:

American Society for Testing and Materials. ASTM Standards on Lead-Based Paint Abatement in Buildings. ASTM, Philadelphia, PA., November 1994.



# **SECTION XIII: ASBESTOS SAMPLING**

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# SECTION XIII: ASBESTOS SAMPLING

## PREFACE

- After November 28, 1992, the Asbestos Hazard Emergency Response Act (AHERA) requires all persons inspecting for asbestos or designing or conducting asbestos response actions in public and commercial buildings to be accredited in accordance with the Model Accreditation Plan
- Inspecting is defined as:  
  
an activity undertaken to determine the presence or location, or to assess the condition of friable or nonfriable Asbestos Containing Building Material (ACBM) or suspected ACBM, whether by visual or physical examination, or collecting samples of such material.
- Public and commercial buildings are defined as follows:
  - the interior space of any building which is not a school building;
  - includes industrial facilities, office buildings, government-owned buildings, colleges, churches, hospitals, stores, factories, etc.;
  - excludes residential apartment units of fewer than 10 units and detached single family homes.
- Persons who violate these requirements are subject to penalties of up to \$5,000 per day, per violation.

When Bureau of Land personnel encounter ACBM or suspected ACBM in public or commercial buildings they should contact the Bureau of Air Field Operations Section to request assistance and guidance.

## A. REMINDER CHECKLIST

- The following specific procedures should be followed to prepare aqueous sample bottles.
- Use only unused pre-cleaned glass bottles (polypropylene should be avoided since problems of particulate being released into water samples have been reported.)

- Before use the bottles should be rinsed twice by filling one-third full with fiber-free water and shaking vigorously for thirty seconds.

## **B. EQUIPMENT**

The appropriate equipment for sampling asbestos depends on the media being sampled. Refer to the media specific sampling procedures (e.g. waste piles, soils, sediments, surface waters) for a description of the appropriate equipment to be used for sampling for asbestos.

1. Sample container for Bulk / Solid Samples should be an unused 35mm canister or ziplock bag or pre-cleaned screw-capped 4 ounce wide mouth glass jar.
2. Sample container for Aqueous Samples should be an unused, pre-cleaned one liter glass bottle (see checklist above).

## **C. PROCEDURES**

Refer to the procedures in this manual which are specific to the media being sampled. No more than a "thimble full" is required for bulk samples.

# **SECTION XIV: SURFACE WIPE SAMPLING**

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## SECTION XIV: SURFACE WIPE SAMPLING

### A. REMINDER CHECKLIST

#### 1. Pre-Sampling Activities

- Assess site hazards, and develop and/or review a safety plan.
- Develop and/or review sampling plan.
- Establish purpose(s) of sampling.
- Obtain necessary sampling equipment and supplies:
  - Wipe media (as appropriate).
    - 3" X 3" soxlet extracted cotton gauze pads.
    - 7 cm (2.8-inch) Whatman 42 filter paper.
    - Commercially available baby wipes (see Lead-Based Paint Residue Method below).
  - Wipe solvent (as appropriate).
    - Distilled, Deionized water.
    - Hexane (Pesticide grade).
    - Other appropriate organic solvent (Pesticide grade or equivalent).
  - Sample containers (glass with Teflon® lined lid).
- Disposable gloves, at least one pair for each sample and compatible with the solvent used.
  - Metal Ruler (approximately 6-inches or larger) graduated in centimeters.
  - Masking template for sample area of 100 cm<sup>2</sup>.
    - Prepared template (10 cm X 10 cm), or
    - Non-corrugated cardboard (such as plain manilla file folders - no colors) for making templates.
  - Masking tape to hold templates in place.
  - X-Acto® or equivalent knife for cutting templates in the field or to fit odd shaped surfaces.

- Prepare sample containers (by inserting wipes and solvent in each) if appropriate.
- Obtain waste container for used PPE, used templates and excess solvent.
- Schedule lab time two weeks in advance when possible.
- Be prepared to sample in extreme climatic conditions.
- If necessary, contact the site owner/operator prior to the sampling event to obtain permission to gain access to the site, to discuss the purpose of the sampling, to address any safety and security concerns at the site, and to coordinate replicate samples if requested by the owner/operator.
- Determine the number and type of QA/QC samples necessary for the sampling objectives.
- Sample documents and chain-of-custody forms.
- Camera and film or videocam, as necessary to document sample location.
- Cooler and icepacks to maintain 4°C during sample shipment.
- When necessary, packing materials for shipping the sample(s).

## 2. During Sampling Activities

- Document the sampling event. At a minimum, the ambient temperature, date, time, sampler's name, photos or video, any deviations from the original sampling plan, and any problems encountered.
- Collect the samples in areas of least expected contamination first.
- Collect any media blanks before collecting samples.
- If necessary monitor air in breathing zone of sampler to determine if respiratory protection level is appropriate.
- Wipe off sample bottles prior to placing in cooler.
- Change outer disposable gloves between individual wipe sample locations.
- Keep sample bottles in coolers at 4°C, sealed and maintain chain of custody.

### **3. Post-Sampling Activities**

- Decontaminate all field equipment and PPE if appropriate, in accordance with the Health and Safety Plan. Return all reusable equipment to the IEPA warehouse or its place of origin. Label any malfunctioning equipment and notify its custodian.
- Classify and properly dispose of all waste generated properly.
- Keep all samples cool and ship or deliver to appropriate laboratory.

## **B. PROCEDURES**

### **1. Field Quality Assurance and Quality Control**

#### **a. Prevention of Cross Contamination**

By its nature wipe sampling involves a lot of hand contact with various surfaces that may easily result in cross contamination. The key to prevention is the appropriate sequencing of actions to eliminate opportunities for cross contact. Performing a "dry run" of the sampling process should identify adjustments that need to be made. Details like having: the waste container open and ready, the sample bottles pre-labeled, spare gloves accessible, etc. are key to preventing the entire sampling and analysis effort being negated because of cross contamination.

Because the wipe sampling involves so much hand contact, frequent glove changes are necessary to avoid cross contamination. Therefore the gloves selected should be economical, yet be compatible with the solvent used and not contribute contamination of itself. Depending upon the contaminant and solvent media, an inner protective glove of more durable construction/materials may be combined with a cheaper outer glove which is changed frequently (with each sample). It may also be helpful to wrap the exterior of sample containers.

#### **b. QA/QC Samples**

Where the potential exists for pre-existing contamination of the sample media, media blanks should be obtained. In the case of wipe samples this would include using the gloves, solvent and wiper to wipe one of the templates and then containerizing the exposed wiper in a sample jar just like an objective sample would be handled. Of course the number of blanks used

and whether they would be analyzed would depend upon the sampling objectives and the outcome of the objective samples analyses. It would not be necessary to actually analyze the blanks if the objective samples were non-detect or below a level of regulatory concern for the contaminants of interest. Generally one blank should be collected for every ten wipe samples taken at a sampling session.

## 2. Selection of Methodology

With the exception of a few chemicals, such as lead and polychlorinated biphenyls, there are not currently any widely accepted protocols for determining acceptable levels applicable to wipe samples. This fact significantly limits the applicability of wipe samples as proof of cleanup to levels protective of human health and the environment. However, this may change in the future. On the other hand wipe samples are currently useful in determining the presence or absence of contamination, within the detection range of the analytical method.

Most current wipe sample methodologies specify a 100 cm<sup>2</sup> area of substrate being wiped. While increasing the area and then scaling back the results can increase the sensitivity, by effectively lowering the detection limit per area, there is a greater chance that the wipe material will become abraded and sample will be lost.

The selection of solvent is also important. The solvent used must readily dissolve the contaminant(s) of interest and yet be compatible with the analytical method. Solvents of suitable purity are also important and purity level should be selected in consultation with the lab. Common solvents are DI or Nanopure water, methanol, hexane and methylene chloride. Also to be considered is that the solvent chosen should not damage the surface being sampled. When skin is the sampled surface, only water should be used as other solvents may increase the absorption of contaminants through the skin. When conducting the sampling, the wipes used should be wetted consistently with the solvent, the wipe conducted and the sample sealed in the sample containers quickly to assure consistent transfer and retention of the contaminant(s) of interest. To assure consistent wetting it is often recommended that wipes be pre-wetted in the sample containers with a measured amount of solvent and be allowed to equilibrate.

Selection of the sample location affects the consistency of wipe samples in that smooth surfaces, such as glass, metal, and painted surfaces, are more likely to result in maximal transfer of contaminant(s) to the wipe while rougher surfaces such as unsurfaced concrete, brick or textiles are more likely to retain more of the contaminant(s) in pore spaces and other crevices which the wipe cannot effectively reach. Wiper materials such as glass wool may be more effective on rougher surfaces. Other materials used as wipers include glass wool, analytical chemist's



filter paper, gauze pads.

### **3. Sample Locations**

There are three strategies for selection sample locations. The first is to randomly select the sample locations. This is generally appropriate when a relatively large number of samples will be taken and statistical manipulations are anticipated of the sample data. The number of samples and the determination of random locations can be determined in a similar manner used for other surface media sampling.

The second strategy is to sample areas of suspected high contamination. These can be selected based on visual stains or proximity to a suspected source. Consideration of the means of contaminant transport and the affinity of the receiving surface for the contaminant can also indicate likely locations of high contamination. This strategy is most applicable for initial screening for the existence of contamination.

The third strategy is to sample areas that are most likely to form part of a future expose pathway. For instance, these might be areas where skin contact is likely or where high contact is likely with secondary surfaces such as shoes that can transfer the contaminant to tertiary surfaces which may have high skin contact rates, such as residential carpets. This strategy can be employed to confirm cleanup when relatively few samples will be taken.

### **4. Sample Collection**

#### **a. TSCA PCB Sampling Method <sup>1,2,3</sup>**

If the surface to be samples is smooth and impervious (e.g., rain gutters, aluminum house siding), a wipe sample should indicate whether the cleanup has sufficiently removed the PCBs. These surfaces should be sampled by first applying an appropriate solvent (e.g., hexane) to a piece of 11 cm filter paper (e.g., Whatman 40 ashless, Whatman "50" smear tabs, or equivalent) or gauze pad. This moistened filter paper or gauze pad is held with a pair of stainless steel forceps and used to thoroughly swab a 100-cm<sup>2</sup> area as measured by a sampling template.

Care must be taken to assure proper use of a sampling template. Different templates may be used for the variously shaped areas which must be sampled. A 100 cm<sup>2</sup> area may be a 10 cm x 10 cm square, a rectangle (e.g., 1 cm x 100 cm or 5 cm x 20 cm), or any other shape. The use of a template assists the sampler in the collection of a 100 cm<sup>2</sup> sample and in the selection of representative sampling sites. When a template is used it must be

thoroughly cleaned between samples to prevent contamination of subsequent samples by the template.

The wipe samples should be stored in precleaned glass jars at 4° C. Before collection of verification samples, the selected filter paper or gauze pad and solvent should be used to generate a field blank.

Wipe sampling is inappropriate for surfaces which are porous and would absorb PCBs. These include wood and asphalt. Where possible, a discrete object (e.g., a paving brick) may be removed. Otherwise, chisels, drills, saws, etc., may be used to remove a sufficient sample for analysis. Samples less than 1 cm deep in the surface most likely to be contaminated with PCBs should be collected.

The approved IEPA QAPP<sup>2</sup> for TSCA samples specifies that the appropriate container for wipe samples is 125 ml amber glass jar with a Teflon lined cap that is stored at 4° C.

The PCB Inspection Manual<sup>3</sup> indicates that isooctane be used instead of hexane and also indicates that using a rubber glove to hold the paper or pad, dip it into isooctane and to thoroughly rub it over a 100 cm<sup>2</sup> area is acceptable.

b. NIOSH Chlorinated Dioxin and Furan Method<sup>4</sup>

Surface samples for PCBs, PCDFs, and PCDDs will be collected according to the wet-wipe protocol established by the New York State Department of Health for surfaces in the Binghamton state Office Building. This wet-wipe protocol was also used to assess these contaminants resulting from transformer fires in San Francisco and Tulsa.

The surface wipe samples are collected using 3" x 3" Soxhlet extracted cotton gauze pads. The sampling procedure consists of marking off a surface into 0.25 m<sup>2</sup> areas using a template or an appropriate measuring device. Each area is wiped with a 3" x 3" gauze pad which has been wetted with 8-ml of pesticide grade hexane. The wet wipe sample pad is wiped in two directions (the second direction is performed at a 90° angle to the first direction). Each gauze pad is used to wipe only one 0.25 m<sup>2</sup> area. The gauze pad is placed in a glass sample container equipped with a Teflon® lined lid.

Each PCB wipe sample will consist of a single sample from an area of 0.25 m<sup>2</sup>. The four PCDF/PCDD gauze pads are composited and treated as a single sample to attain an acceptable detection limit.

c. OSHA Method <sup>5</sup>

This procedure is used in conjunction with other situation specific information to establish whether or not there is a health risk due to a potential for dermatitis and/or that a hazardous quantity of a material can be absorbed through the skin on contact with a sampled surface. It can also be used to evaluate potential ingestion hazards.

Using a clean, impervious disposable glove, remove a "Whatman 42" 7-cm (2.8-inch) filter from its box. Moisten the filter with water (unless other collection media have been specified). If possible, wipe approximately 100-cm<sup>2</sup> of the area with the moistened filter. Without allowing the filter to contact other surfaces, fold it with the exposed side in, and then fold it over to form a 90° angle in the center of the filter. Place a filter, angle first, into a clean glass vial, replace the top, and seal it with evidence tape.

A blank filter also moistened with water (or the collection medium) should be submitted in a separate vial to the laboratory with the samples.

OSHA has a field screening test for carcinogenic aromatic amines in which 5 drops of methanol replaces the water and is placed in the center of the filter paper. After sampling, 3 drops of fluorescamine is applied to the contaminated area of the filter and one drop to a non-contact area of the filter as a blank indication. After a reaction time of 6 minutes, the filter is irradiated with 366 nm ultraviolet (UV) light. Differential discoloration of the blank and sample area is presumptive for aromatic amine contamination and another sample should be obtained with the methanol solvent and sent to a lab for confirming analysis. The aromatic amines which turn yellow with fluorescamine are: Benzidine, 4,4'-Methylene bis(2-chloroaniline), 3,3'-Dichlorobenzidine, alpha-Naphthylamine, beta-Naphthylamine, and 4-Aminobiphenyl.

d. Lead-Based Paint Residue Method

See Section XII for specifics on wipe sampling for lead dust.

e. Generic Considerations

When a specific sampling methodology is not specified for contaminant(s) of interest, several factors need to be considered. The first is that the materials used for sampling are compatible with the contaminant(s) and do not degrade or change the contaminants in a manner that precludes their subsequent detection. The second factor is that the size of the area sampled must be proportioned such that the analytical method used will detect a mass

of contaminant that when related to the area sampled will be within the range of the "clean" threshold target value. The third factor is that the analytical method chosen must be for the chemical speciation upon which toxicity values are based (i.e., ionized vs. total metal speciation).

## C. REFERENCES

1. Verification of PCB Spill Cleanup by Sampling and Analysis, USEPA (August 1985). EPA-560/5-85-025; pages 41 and 42.
2. Quality Assurance Program Plan. Illinois EPA, Toxics Substances Control Act. PCB Inspection Program (August 1990); Section 6, page 2 of 3.
3. PCB Inspection Manual , USEPA (DRAFT-November 1992), page 5-16.
4. Final Test Plan. Sampling and Analysis of Surfaces and Air for Polychlorinated Biphenyls, Dibenzofurans and Dibenzodioxins: Annex Building, New Mexico State Highway Department, NIOSH (DRAFT--August 1985).
5. " U.S. Occupational Safety and Health Administration. Office of Science and Technical Assesment. Sampling for Surface Contamination: Section I - Chapter 2 of OSHA Technical Manual, OSHA Instruction TED series, No. 1.15. Washington, D.C. : U.S Department of Labor, May 24, 1996.

# **SECTION XV: SAMPLING WITH THE GEOPROBE**

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# SECTION XV: SAMPLING WITH THE GEOPROBE

## A. REMINDER CHECKLISTS

### 1. Pre-Sampling Activities

- \_\_\_ Assess site hazards and develop and/or review the site safety plan.
- \_\_\_ Develop and/or review the sampling plan.
- \_\_\_ Establish purpose(s) of sampling.
- \_\_\_ Obtain necessary sampling and monitoring equipment; decontaminate or pre-clean the equipment, and ensure that it is in working order.
- \_\_\_ Schedule the Geoprobe unit for use as well as an operator.
- \_\_\_ Bring enough clean water for rinsing, cleaning, and cooling off.
- \_\_\_ Schedule lab time and order bottles.
- \_\_\_ Be prepared to sample in extreme weather conditions.
- \_\_\_ Schedule a meeting prior to the trip to ensure all sampling members understand their roles and responsibilities.
- \_\_\_ Schedule a JULIE or DIGGER meet.
- \_\_\_ Review site geology, hydrogeology, and potential contaminants and their behavior.
- \_\_\_ If necessary, contact owner/operator prior to the trip to schedule the sampling event, to gain access to the site, to discuss the purpose of the sampling event, and to address any safety and security concerns at the site.
- \_\_\_ Identify local suppliers of sampling expendables (e.g. ice, plastic bags, overnight delivery, and recharge of SCBA air tanks if necessary).
- \_\_\_ Prepare your sample containers prior to sampling (label and organize).

## **2. During Sampling Activities**

- \_\_\_ Document the sampling event - at a minimum include weather conditions, date, time, sampler's name, photographs, any deviations from the original sampling plan, and any problems encountered.
- \_\_\_ Collect samples in order of volatilization. Special care is needed when collecting VOC samples.
- \_\_\_ If necessary monitor the air in the area where sampling is taking place so that you can adjust your level of protection.
- \_\_\_ Keep sample bottles in coolers properly preserved, sealed, and maintain chain of custody.
- \_\_\_ Never composite VOC samples.
- \_\_\_ Wipe off the outside of the sample bottles prior to placement in cooler.
- \_\_\_ Perform a general site survey prior to site entry.
- \_\_\_ Identify all sampling locations. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions. All locations must be utility-cleared.
- \_\_\_ Always take background samples from the same soil types and from similar depths as the on-site samples.

## **3. Post-Sampling Activities**

- \_\_\_ Decontaminate all field equipment, and PPE if appropriate, in accordance with the Health and Safety Plan. Return all usable equipment to the IEPA warehouse or its place of origin.
- \_\_\_ Classify all waste generated (i.e. IDW, baggies, contaminated PPE) and dispose of properly.
- \_\_\_ Keep samples cool; ship or drop off to appropriate laboratory.
- \_\_\_ Separate incompatible wastes so that they are not transported in the same cooler.

- Seal odorous wastes in a cooler to avoid breathing vapors or odors during transportation.
- Transcribe field notes to memorandum form or report form and submit to the Bureau File, include photographs and a sketch of the site with sampling locations clearly identified.

## **B. EQUIPMENT CHECKLIST**

See the checklist on the following page for appropriate sampling equipment.



## SAMPLING EQUIPMENT CHECKLIST

### **PAPERWORK:**

- ☐ IEPA Identification
- ☐ Safety Training Certification
- ☐ Lab Phone Numbers
- ☐ Site Map & Directions
- ☐ Chemical Analysis Forms
- ☐ Chain of Custody Forms
- ☐ Receipt for Samples (RCRA sites only)
- ☐ Field Log Forms or Field Log Book

### **PROJECT MANAGER:**

- ☐ Field Logbook
- ☐ Aluminum Case (for paperwork)
- ☐ Calculator
- ☐ Camera
- ☐ Pencils & Pens
- ☐ China Markers
- ☐ Compass
- ☐ Pocket Knife
- ☐ Emergency Raingear
- ☐ Paper Towels
- ☐ PPE Gloves
- ☐ pH Paper
- ☐ Decon Spray Bottles:
  - ☐ Liquinox Solution
  - ☐ Deionized/Distilled Water

### **GENERAL SAMPLING EQUIPMENT:**

- ☐ Geoprobe and Operator
- ☐ Sample Bottles
- ☐ Extra Bottle Labels
- ☐ Waterproof Clear Tape
- ☐ Visqueen (pre-cut)
- ☐ Utility Knife or Pocket Knife
- ☐ Portable Table
- ☐ Garbage Bags
- ☐ Rain Canopy & Poles
- ☐ Nylon Rope
- ☐ Water Camers
- ☐ Paper Towels
- ☐ Duct Tape
- ☐ Masking Tape
- ☐ Flashlights & Batteries
- ☐ Binoculars
- ☐ Aluminum Foil
- ☐ Shovel
- ☐ Trowel/Sampling Spoons
- ☐ Machete
- ☐ Extra Tubing
- ☐ Peristaltic Pump
- ☐ Bailers
- ☐ Disposable Filter Cartridge

### **FOR DECON:**

- ☐ Spray Bottles:
  - ☐ Liquinox Solution
  - ☐ Distilled/Deionized Water
- ☐ ½-Gallon Jugs:
  - ☐ HCL: dilute to 5 or 10%
  - ☐ Liquinox Solution
  - ☐ DI Water
- ☐ 5-Gallon Sprayers:
  - ☐ Liquinox Solution
  - ☐ Tap Water
  - ☐ Extra Gallons of DI Water
  - ☐ Paper Towels
  - ☐ Aluminum Foil
  - ☐ Brushes
  - ☐ Plastic Tubs
  - ☐ 5-Gallon Plastic Buckets
  - ☐ Garbage Bags

### **FOR FIELD MEASUREMENTS:**

- ☐ Passport
- ☐ PID
- ☐ FID
- ☐ pH/Temp/Millivolt Meter
- ☐ Battery: 9-volt
- ☐ pH Buffers: 4, 7, & 10
- ☐ Radiation Detector
- ☐ Draeger Pump, Tubes

### **PPE, SAFETY & SUPPORT:**

- ☐ Cleaning & Cooling Water
- ☐ Drinking Water
- ☐ Gatorade
- ☐ Ice for Drinking Water
- ☐ Hand Soap/Goop
- ☐ First Aid Kit
- ☐ Insect/Tick Repellent
- ☐ Sunscreen
- ☐ Fire Extinguishers
- ☐ Walkie Talkies
- ☐ Full-Face Respirators
- ☐ Cartridges
- ☐ SCBAs
- ☐ Cylinders
- ☐ Field Chairs
- ☐ Disposable Booties
- ☐ Tyvek
- ☐ Saranex
- ☐ Raingear
- ☐ Cotton Coveralls
- ☐ Insulated Coveralls
- ☐ Steel-Toed/Shanked Boots
- ☐ Insulated Pack-Boots
- ☐ Hardhat/Face Shields
- ☐ Nitrile/Butyl Rubber/Neoprene Gloves
- ☐ Glove Liners

### **SEALING & TRANSPORTATION**

- ☐ Coolers
- ☐ Blue Ice
- ☐ Dry Ice
- ☐ Regular Ice
- ☐ Large Liners for Coolers
- ☐ 1-Gallon Ziplock Bags
- ☐ Quart Ziplock Bags
- ☐ Large FDA Cooler Bags
- ☐ Evidence Tape
- ☐ Strapping Tape

## C. COMPLETE GEOPROBE EQUIPMENT LIST

The following is a list of equipment that is necessary to operate the Geoprobe. This equipment will be necessary in addition to the sampling equipment on the previous checklist. In most instances the Geoprobe operator will be responsible for gathering this equipment and making sure that it is working order.

- \_\_\_ One utility vehicle with the Geoprobe model 8A mounted.
- \_\_\_ Hardened steel rod, 3 feet long, 1-inch OD, ½-inch ID.
- \_\_\_ Drive caps.
- \_\_\_ Anvil.
- \_\_\_ Expendable drive point.
- \_\_\_ Sampling cap.
- \_\_\_ Pull cap.
- \_\_\_ Expendable point holder.
- \_\_\_ Carbide-tipped drill bit.
- \_\_\_ Well point.
- \_\_\_ Water trap.
- \_\_\_ Soil-gas sample collection vessel; 250-ml bulb with Teflon septum or three-liter evacuated stainless steel sampling canister.
- \_\_\_ Macro-Core or large bore sampler.
- \_\_\_ Macro-core sample liners.
- \_\_\_ Large bore sample liners.
- \_\_\_ Hose clamps.
- \_\_\_ Vacuum gauge.
- \_\_\_ Polyethylene and/or tygon tubing.

Various accessory tools are required for Geoprobe operation. These include pipe wrenches in a variety of sizes, standard and phillips screwdrivers, various hammers, such as rock hammers and sledges, pliers and vice grips, wire cutters and electrical and duct tape.

## **D. PROCEDURES**

### **1. Soil Sampling With The Geoprobe**

If collection of soil samples with the Geoprobe is anticipated, the geoprobe unit and a trained Geoprobe operator must be obtained in advance (Figure 15a).

The utility companies must be contacted by the project manager through JULIE (DIGGER in Chicago) and a site meet scheduled before Geoprobe work begins.

Soil samples can be collected two ways with the Geoprobe - Macro-Core Sampling and Large Bore Sampling.

#### **a. Macro-Core Sampling**

The Macro-Core device is used to make continuous cores to depths of up to 30 feet (Figure 15c). The Macro-Core is a 4 foot long stainless steel tube with an outer diameter of 2 inches and an inner diameter of 1.5 inches.

- i. The samples are taken in four foot intervals with probe rods being attached to the sampler for depths beyond 4 feet.
- ii. A plastic liner is inserted into the tube, a cutting shoe is screwed onto the lower end of the tube and a drive head (with drive cap) is screwed onto the upper part of the tube. The drive head is then placed under the Geoprobe anvil and the Macro-Core device is advanced into the ground in 4 foot intervals.
- iii. When the Macro-Core is withdrawn from the hole the pull cap is put on to replace drive cap. The plastic sleeve containing the core is removed from the Macro-Core tube.
- iv. There are plastic caps that can be put on the ends of the sleeve after coring to prevent volatile from escaping from the core. The sample can be collected from the sleeve and sent to the lab or, in some cases, the capped sleeve can be sent directly to the lab.

When coring in loose sediments plastic core catchers can be placed on the end of the Macro-Core to prevent parts of the core from falling out of the bottom of the tube when it is being raised out of the hole.

Care should be taken to prevent overpacking of the soil in the Macro-Core, since this can result in the sleeve swelling in the Macro-Core tube and becoming stuck.

The Macro-Core can only be used in unconsolidated deposits and it is not recommended for use in deposits containing large rocks or debris.

In some cases it is possible to pre-probe through undesirable intervals with probe rods and a large diameter point to prevent damage to the Macro-Core.

b. Large Bore Sampling

The Large Bore Sampler can be used to take a 22 inch long, 1.06 inch diameter core at depths of up to 60 feet (Figure 15b). The Large Bore Sampler is primarily designed to be a discrete sampling device to take a sample at a prescribed depth. The Large Bore Sampler is a 22 inch long, 1.375 inch diameter tube.

- i. A plastic liner is inserted into the tube, a drive head is screwed into the top part of the tube and a cutting shoe is screwed into the bottom part of the tube. The bottom part of the tube contains a piston tip which can be retracted when the sampling depth is reached. Rods are added to the device until the desired sampling depth is reached.
- ii. The piston tip is retracted using Geoprobe extension rods which can be lowered into the hollow probe rods and attach to the piston tip.
- iii. After the piston tip is retracted the Large Bore Sampler is advanced approximately 22 inches to take the core and then the Large Bore Sampler and rods are pulled from the hole.
- iv. Once out of the hole the liner containing the core can be removed from the coring tube. The sample can be collected from the liner or in some cases capped and sent to the lab.

The Large Bore Sampler can only be used in unconsolidated deposits and it is not recommended for use in deposits which contain large rocks

or debris.

c. **Sample Handling**

After the sample collection is complete, the Geoprobe operator will fill in the hole, decontaminate the Geoprobe equipment, and discard unusable equipment.

The handling of sample bottles and order of sample collection should be conducted as described in Section VI.

d. **Other Functions**

There are two other functions that the Geoprobe is capable of - soil gas sampling and breaking through solid materials.

i. **Soil Gas Sampling**

An expendable point is inserted into this holder and the pipe unit is pushed into the ground. The pushing motion is accomplished in the same fashion as inserting the well point. The probe rod is then pulled up approximately one foot to release the expendable point. By pulling the probe up a void is formed from which the vapor sample is collected. After pulling up the probe rod the sample cap is attached again with Teflon® tape or an O-ring. The gas sampling collection system is then hooked up. The hydraulic vacuum pump on board the vehicle is used to create the vacuum. The probe pipe is then removed from the ground leaving the expendable point down the hole.

ii. **Carbide-Tipped Drill Bit**

This bit is for use on concrete, asphalt, or any other hard surface, such as frozen ground. Slowly push down on the probe lever to start the drill into the ground surface.

**2. Groundwater Sampling With The Geoprobe**

If collection of groundwater samples with the Geoprobe is anticipated, the Geoprobe unit and a trained operator must be scheduled in advance (Figure 15a). The utility companies must be contacted by the project manager through JULIE (DIGGER in Chicago) and a site meet scheduled before Geoprobe work begins.

Groundwater samples can be collected a number of different ways using the Geoprobe. Currently used methods of obtaining groundwater samples include pre-coring a hole using a macro-core device and/or some variation of a discrete groundwater sampling device.

a. Macro-Core Sampling

i. Macro-Core Sampling

One method which is often used when attempting to obtain a sample from the unconfined aquifer is to Macro-Core a two inch hole and pump or bail the groundwater sample out of the hole (Figure 15c). This method has the advantage of giving the observer an idea of the lithology of the aquifer. Hole conditions will dictate whether it will be necessary to use screened (or slotted) well pipe or drive rods with a drive point on the end, or if it is feasible to lower open end drill pipe or rods onto the hole (Figure 15d).

b. Discrete Sampling

If the water sample to be collected is from a confined aquifer only or if it is unfeasible to Macro-Core, then a discrete water sample can be collected. The discrete groundwater sampling devices are designed to be driven with a expendable point to a desired depth. The rods are raised a small amount (usually 2-4 feet depending on the type of device) and a screen is exposed. Water then enters the rods or well pipe via the screen and the groundwater sample can be pumped or bailed. Once the sample is collected then the rods and screen are removed leaving the expendable point in the bottom of the hole.

Once the hole is open the groundwater sample can be collected with the use of peristaltic pump, bailer (bailer diameter is dependent on the well pipe or inner rod diameter), or 1/4 inch standard tubing with foot valve. For holes that are pre-cored with a Macro-Core device, any of the above methods can be used to retrieve a groundwater sample. Due to the small inner diameter of the current Geoprobe rods, it is usually necessary to pump the sample out of the hole using a peristaltic pump when taking a discrete sample. However, Geoprobe does make a small foot valve (or check valve) that fits on the end of standard 1/4 inch ID tubing and an oscillating motion pumps a water column up into the tubing. A 20 inch long, 7/16 inch diameter mini-bailer can be used within the Geoprobe drive rods to obtain a 20 mL sample for volatile

organics. The depth of the hole and the depth of the water should be noted.

c. Sample Collection

i. Peristaltic Pump Sample Collection

It is not necessary to purge the sample hole before sample collection because the sample is being collected directly from the aquifer. However, it is sometimes desirable to let the water clear of sediment somewhat before beginning sample collection.

If the sample is to be collected with a peristaltic pump, additional tubing is attached to the peristaltic pump and the tubing is lowered into the hole. The groundwater can be pumped directly into sample containers. Refer to Section VII above.

If the sample is to be filtered, the filter can be attached to the tubing, filling the sample containers with filtered water directly from the hole. Refer to Section VII above.

When using a peristaltic pump, care should be taken not use the pump in a situation which exceeds the recommended lift capacity for that pump (29 feet for pumps currently used by IEPA). If the water level is deeper than the pump's lift capacity, then a different method such as some form of bailing must be used. A common problem associated with pumping water from well pipe which is slotted or contains a screen, is clogging of the slots or screen by silts and clays. When this occurs then the slotted pipe or screen must be brought to the surface and cleaned.

The tubing for the peristaltic pump should be discarded after each use to prevent cross-contamination.

ii. Bailer Sample Collection

It is not necessary to purge the sample hole before sample collection because the sample is being collected directly from the aquifer. However, it is sometimes desirable to let the water clear of sediment somewhat before beginning sample collection.

If a bailer is used to collect the sample, the bailer diameter will be dependent on the well pipe or inner rod diameter. Again, the

sample containers can be filled directly from the bailer. Refer to Section VII above.

If the sample is to be filtered, the groundwater should be bailed from the hole and placed in a clean pre-filtration bottle. Then the sample can be filtered into the sample container. Refer to Section VII above.

d. Sample Handling

The handling of sample bottles and order of sample collection should be conducted as described in Section VII.

After the sample collection is complete, the Geoprobe operator will fill in the hole, decontaminate the Geoprobe equipment, and discard unusable equipment.

## D. REFERENCES

Geoprobe Systems. A Division of Kejr Engineering, Inc. Geoprobe Systems, Model 8-A Operations Manual., 1995., Salina, KS.

U.S. Environmental Protection Agency. A Compendium of Superfund Field Operations.. 12/1987., EPA/540/p-87/001.

## E. FIGURES

15a -- Geoprobe in Boring Position

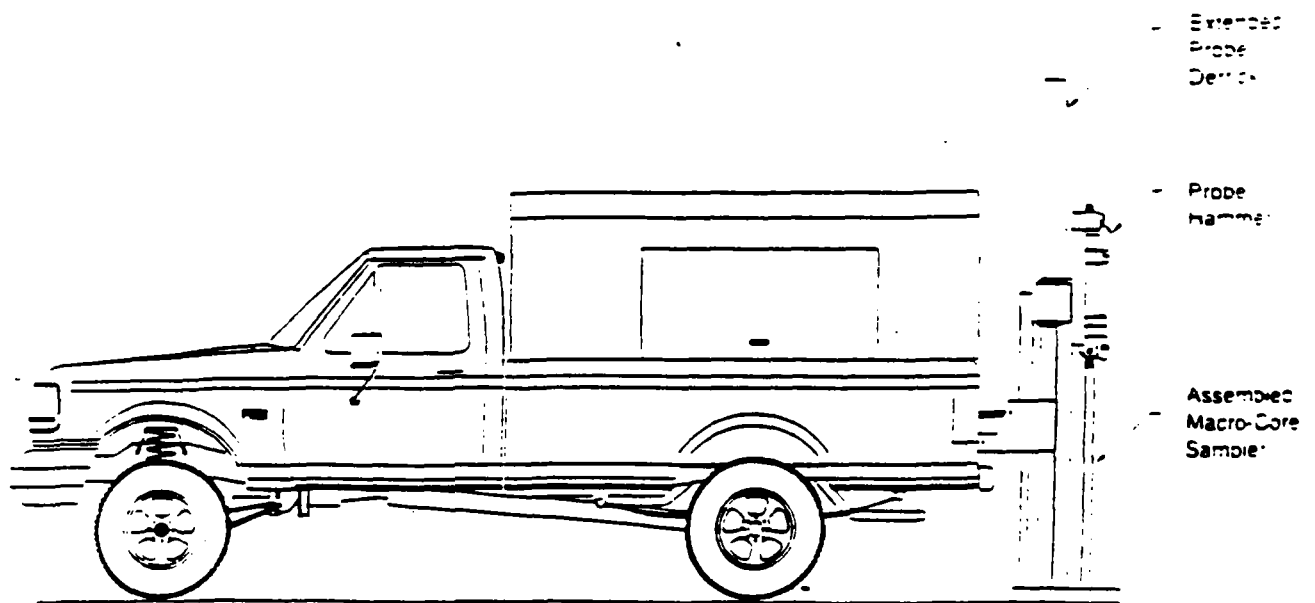
15b -- Macro-Core Soil Sampler

15c -- Large Bore Soil Sampler

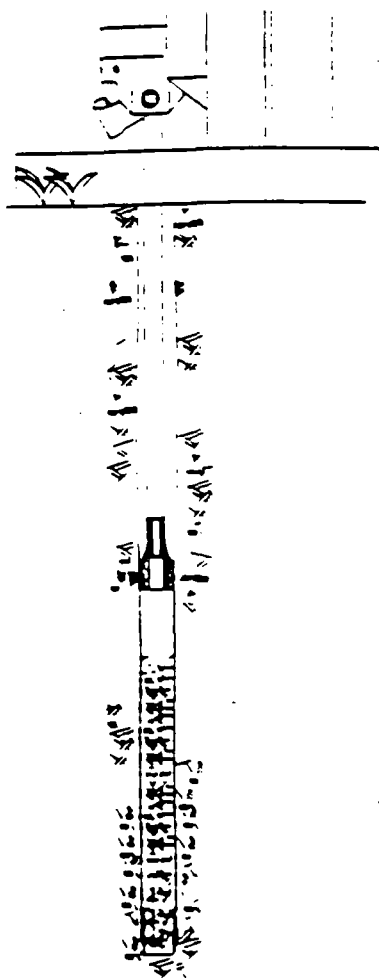
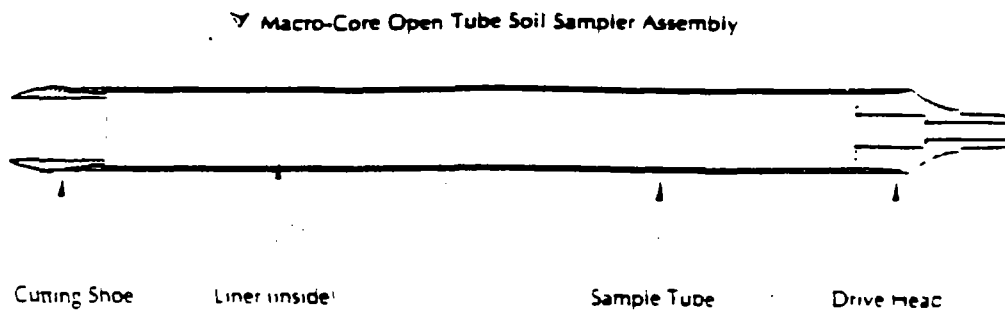
15d -- Screen Point Sampler



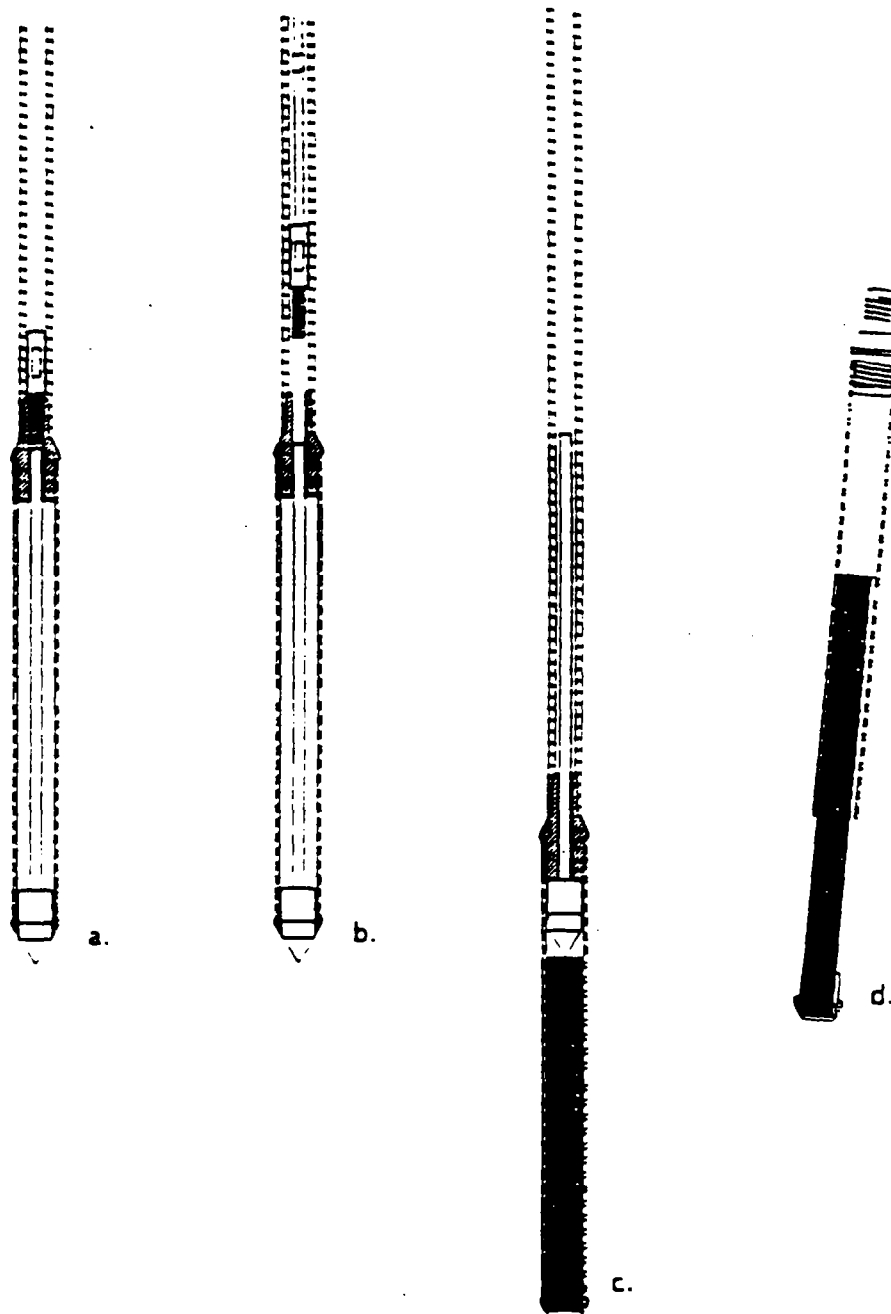
**FIGURE 15a – GEOPROBE IN BORING POSITION**



# FIGURE 15b -- MACRO-CORE SOIL SAMPLER



**FIGURE 15c – LARGE BORE SOIL SAMPLER**



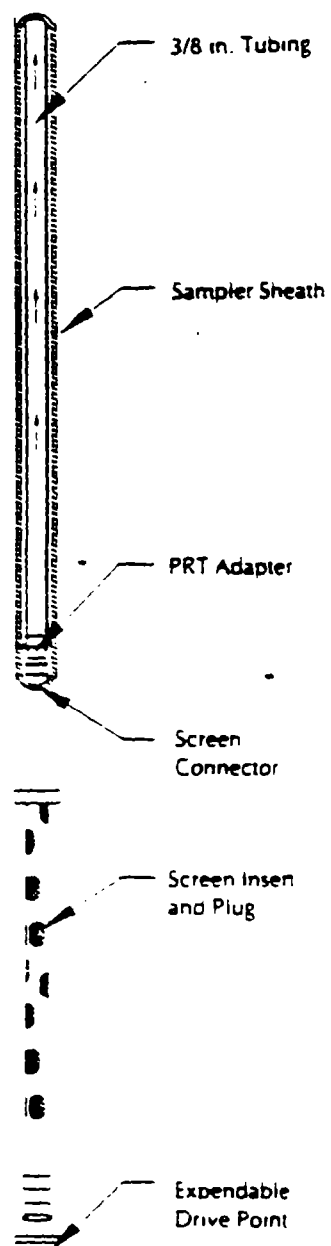
a. Driving the Sealed Sampler

b. Removing the Stop-Pin

c. Collecting a Sample

d. Recovering Sample in Liner

FIGURE 15d -- SCREEN POINT SAMPLER



**APPENDIX D**  
**USEPA GUIDANCE ON FIELD**  
**FILTRATION OF**  
**GROUNDWATER SAMPLES**

## DRAFT GUIDANCE

# DRAFT

## MEMORANDUM

**SUBJECT:** National guidance on field filtration of ground water samples collected from monitoring wells for Superfund site assessment

**FROM:** Stephen D. Luftig, Director  
Office of Emergency and Remedial Response

**TO:** Superfund site assessment field personnel

### Background

The Office of Emergency and Remedial Response (OERR) site assessment program identifies uncontrolled hazardous waste sites with the highest national priority for investigation and possible remediation. This program operates under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986.

The Agency typically evaluates sites in two steps: the Preliminary Assessment (PA) and the Site Inspection (SI). The EPA uses information collected during the PA and the SI to establish remedial priorities using an analytical model known as the Hazard Ranking System (HRS). The HRS is the primary tool the Agency uses to evaluate sites for listing on the National Priorities List (NPL). The HRS analyzes releases of hazardous materials into four pathways, including ground water migration; surface water migration; soil exposure; and air migration.

The Agency collects ground water samples during site assessment to determine whether there has been a release (as defined by Table 2-3 in the HRS) of contaminants to ground water. Comparing release samples to background samples helps to determine if a release has occurred; comparing them to source samples may confirm attribution of the release. The EPA also identifies and characterizes Superfund priority sites by comparing ground water sample data with health-based benchmarks such as maximum contaminant levels (MCLs).

After placing a site on the NPL, the EPA conducts a comprehensive evaluation to identify contaminants, the magnitude and extent of release, and possible response actions. This study, which may begin before a site is added to the NPL, is beyond the scope of this guidance.

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The critical technical issue affecting the collection and analysis of ground water samples is how closely the sample represents ground water as it exists in the subsurface. Ground water sampling techniques involve invasive practices (e.g., drilling the well) which tend to alter the characteristics of the aquifer material and the ground water. It is difficult to obtain a ground water sample which is unquestionably representative of conditions in the subsurface.<sup>1, 2, 4, 5</sup>

Field personnel can minimize the stresses of sample collection on the aquifer and the water sample by employing several practices. These include: proper well design and construction; purging standing water from the well casing; monitoring geochemical parameters of the water to ensure it has reached an equilibrium state; and, using sample collection methods which minimize external stresses on the aquifer materials or the extracted ground water.

\*\*\* Two court cases—Kent County vs. United States, 963 F.2d 391 (D.C. Circuit 1992), and Anne Arundel County vs. United States, 963 F.2d 412 (D.C. Cir. 1992)-- have highlighted the different Regional policies used in Superfund site assessment for ground water samples taken from monitoring wells. In these cases, the Court ruled that EPA had failed to provide sufficient rationale for deviating from a Regional policy which preferred the use of both filtered and unfiltered ground water samples. The Court did not state a preference for filtered or unfiltered samples, but noted that the Agency had not justified the use of only one method.

In the ideal sampling situation, analytical results from filtered and unfiltered ground water samples should be virtually identical. Proper preparation and sampling should produce negligibly small differences between filtered and unfiltered samples of ground water.<sup>2</sup> Based on this knowledge, many risk managers assumed that sample turbidity was likely induced (due to improper sampling techniques.) This belief ignored limitations of the geologic formation and well installation and sampling techniques.

Regardless of how the turbidity in the sample is created, its presence can adversely impact the representativeness of the sample. For inorganics, the process of preserving metal samples with acid causes suspended metal particulates to dissolve, and may increase the concentration of metals of concern in the sample. For organics, contaminants sorbed to entrained sediment would similarly impact analytical accuracy. The purpose of filtering the sample was therefore to remove presumably entrained particulate matter and associated materials.<sup>9, 11</sup> In this case, unfiltered samples of ground water would represent total contaminant concentrations, and filtered samples would determine the dissolved fraction of total contaminants which were mobile in the subsurface.<sup>15</sup>

However, a growing body of scientific evidence suggests that removal of either natural or entrained turbidity may not be a reversible process which can be performed without affecting the original characteristics of the sample. Filtering ground water samples may significantly alter the samples and impair the accuracy of sample analysis.<sup>1, 2, 6, 15</sup> Significant disagreement also exists

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over what causes filtered and unfiltered ground water sample analyses to differ.<sup>9, 11, 14, 15</sup>

### Objective

This objective of this guidance is to resolve some of the questions regarding field filtering of ground water samples taken from monitoring wells for site assessment purposes. The guidance states the OERR site assessment program's preference for unfiltered ground water samples from monitoring wells, and establishes guidelines for field sampling personnel in instances where site conditions may warrant a modified sampling or sample handling approach.

Ground water sampling activities are usually designed to satisfy one or more of four basic objectives: **detection, assessment, resource evaluation, and geochemical modeling**. The site assessment program is most interested in the first two objectives: (1) to determine if hazardous constituents, contaminants, or pollutants have been released into the environment; and, (2) to determine if concentrations of released materials are above health-based benchmarks, and pose an unacceptable risk to human health or the environment.

By establishing a preference for unfiltered ground water samples, the site assessment program intends to eliminate disputes over the interpretation of analytical data and to support an appropriately conservative data quality standard for screening assessments.

\*\*\* A conservative data standard is appropriate for site assessment because the program often evaluates sites based on a limited number of samples (hence the term, screening assessment.) This guidance might not be broadly applicable to more detailed site characterization or risk assessment, because of the increased resources and time allotted to these activities. When sufficient analytical evidence is available, it is possible and desirable to establish whether filtered and unfiltered sample results differ, and for what reason such a potential difference might arise.

### Implementation

In support of the Superfund site assessment program's preference for unfiltered ground water samples taken from monitoring wells, OERR establishes the following guidelines to ensure that ground water samples will meet programmatic needs.

#### 1) Field Log Books

Accurate field notes are as important as the sample collection technique. Beyond the standard notations of date, time and location, field personnel should record all field measurements; purging volumes and times; extraction rates; pH; temperature; specific conductance; turbidity; water levels and drawdown; conductivity (Eh), and dissolved oxygen (optional, but strongly suggested); the sampling method; and the rationale for sampling method.



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selection, if it differs from the established work plan. Notes should be understandable and thorough, since they may support future Agency decisions for the site.

### 2) Sampling and sample quality

Collection of representative ground water samples depends on a number of factors. Proper design, construction, development and purging of the well are all crucial to this process. Site assessment personnel should collaborate with appropriate experts (including human health and ecological risk assessors, the regional hydrogeologist, and others) to ensure that these important first steps have been taken and properly documented.

The Site Assessment Manager (SAM) must first determine the overall objectives of the sampling event, and then identify the best sample collection method. The ideal sampling technique involves the least possible disturbance or change in the chemical properties of the sample. Research shows that poor ground water sample quality is primarily caused by two field practices: purging or sampling a well too quickly, and filtering the sample.<sup>1</sup> Proper sampling techniques can reduce or eliminate these effects. SAMs should consider the following guidelines to minimize induced turbidity:

- a) Minimize subsurface disturbance by avoiding high pumping rates;
- b) Place the sampling device intake at the interval where contamination is suspected;
- c) Monitor water quality indicators during purging; and,
- d) Minimize atmospheric contact with samples.

These techniques should allow for the collection of high-quality ground water samples. In most cases the resulting sample will have low turbidity and few sampling artifacts.<sup>1,2,10,14,15</sup>

OERR offers sampling guidelines and protocols in the Compendium of Superfund Field Operations Methods. However, the EPA regions independently establish their own Standard Operating Procedures for sample collection techniques. This allows the regions to account for variations in geology, hydrologic regimes, individual site characteristics, and data objectives.

Ground water samples are used to evaluate many different kinds of contaminants. The sample collection technique and the appropriateness of filtering vary, depending on the intended use. For example, it is generally accepted that samples for organic compounds should not be filtered. Samples for metalloids and radionuclides should not be filtered, since this could remove mobile and highly toxic contaminants from the sample. Filtering is also unacceptable where significant water movement occurs in secondary permeability features such as fractures, solution channels, or macropores. Samples from drinking water wells should never be filtered because an individual would usually drink well water unfiltered.

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Samplers should strive to obtain three stable consecutive measurements of one or more standard field parameters as an indication of well stabilization. For example, a turbidimeter can determine if turbidity levels stabilize during purging, or whether natural turbidity or sampling artifacts exceed acceptable levels in nephelometric turbidity units (NTU). Other field indicators (such as water temperature, pH, and specific conductance) may also be tracked to determine well stabilization.

OERR recommends that field personnel monitor up to three field indicators to determine well stabilization during purging. When appropriate, water which has been tested with field meter probes should be treated as investigation-derived waste for disposal. These samples should never be analyzed as representative ground water samples.

### 3) Minimizing filtering effects

Inorganic contaminants and metals may occur naturally in ground water; organic contaminants generally do not. Historically, ground water samples were filtered in an attempt to exclude naturally occurring metals and non-mobile organics which are sorbed to aquifer matrix elements, and to ensure that only site-related inorganic contaminants were evaluated. A growing body of evidence indicates that filtration may not achieve this goal, and instead may alter the characteristics of site-related hazardous constituents in a ground water sample. As a result, filtering these samples is unacceptable as an alternative to proper sampling methods.

Sample agitation, aeration, and rapid purge and sample rates may induce physical and chemical changes in a sample, including induced turbidity, exposure of fresh suspended sorptive surfaces (capable of adsorbing dissolved contaminants), mixing (may cause dilution), oxidation, and other changes in metal speciation.<sup>1</sup> Any of these could affect sample analysis in the laboratory.

Filtering a ground water sample to correct for poor sampling technique may remove contaminants which exist in the environment in the dissolved and mobile phase, or small colloidal metals which are mobile. The resulting sample analysis will not accurately reflect the true concentrations for these contaminants (false negative). In comparison, proper sampling techniques which minimize stress to the well/aquifer interface should achieve acceptably low levels of induced turbidity without the risk of altering the sample by filtering.<sup>2, 6</sup> This is why OERR prefers sampling techniques which do not induce turbidity, and the use of unfiltered ground water samples for metals analysis for Superfund site assessment purposes.

If it is not possible to attain reasonably low turbidity levels, the sampler may decide to collect both filtered and unfiltered samples. However, when the analyses of filtered and unfiltered ground water samples differ, this approach may not reveal the reason for the difference. Furthermore, the dual sampling approach will significantly increase the time and expense of

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sampling, analysis and disposal activities.

OERR strongly recommends against filtering ground water samples taken from monitoring wells for site assessment. In cases where field personnel identify the need to filter a sample, OERR recommends a 10.0 $\mu$ m filter (this is the generally accepted upper limit of the size of colloidal particles). This pore size allows site investigators to monitor for mobile colloids because (1) it is a conservative upper size limit when the filter is clean and before plugging with sediment, and (2) some evidence indicates that smaller pore size filters (ie, 5 $\mu$ m) may effectively exclude latex model spherical colloids as small as 1 $\mu$ m.

Generally, filter manufacturers make quantitative claims concerning only the size of particles which will be trapped by a filter. The stated filter pore size does not guarantee that smaller particles will, in fact, pass through the filter. Furthermore, as a filter becomes clogged with use, the effective pore size may decrease, removing progressively smaller particles from the sample over time. Thus, the preference for unfiltered samples reflects the conservative, screening type assessment which is performed in the Superfund site assessment program.

EPA recognizes that there are instances where field personnel might choose to field filter ground water samples. For example, it may be impossible or impracticable to sample in a way which does not stress the well/aquifer interface. In some cases, it may be necessary to sample wells which were not designed, constructed or developed in an optimum manner. Filtering such samples would then be the only acceptable way to obtain a usable groundwater sample. In extremely arid environments, even low-flow purging may pump the well dry. The relevant facts should be clearly documented to justify the need for filtering the samples.

Problems encountered when filtering ground water samples include difficulty maintaining a dust-free atmosphere during filtering,<sup>7</sup> the possibility of excluding components of the contaminant load (i.e., clay minerals and humic materials with strong sorptive capabilities;)<sup>2</sup> and the risk of false negatives (unfiltered samples give a more conservative contaminant mobility estimate.)<sup>6</sup> Field personnel should take measures to avoid these problems, and carefully document these measures in the sampling log book.

### Cost Considerations

The costs associated with collecting both filtered and unfiltered samples could greatly increase current estimates for sampling, analysis and disposal without providing significant new information about ground water conditions at the site. OERR does not recommend this approach for Superfund site assessment purposes.

Some field personnel prefer to filter out suspended silt and clay from ground water samples, instead of properly developing, purging and sampling wells.<sup>11</sup> However, the time saved

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by rapid sampling may be lost during the time required to filter, and the resources dedicated to future disputes over data quality may dwarf the small savings in field sampling time. In contrast, when used appropriately, proper purging and sampling techniques may actually reduce sampling time and produce higher quality, more representative samples.

The costs associated with appropriate sampling techniques may be comparable to the costs for filtered samples. This is especially true when one considers the reduced volume of investigation-derived waste that may be produced by low-flow sampling technique. Time and resource constraints should never be an excuse for sampling techniques that impair data quality. Rather, the concern over the cost of sampling should reflect the lifecycle costs created by that potentially flawed data set. A bad sampling event, while potentially cheaper up front, may incur very high lifecycle costs down the road.

### Conclusion

EPA research laboratories, technical groups, and site assessment staff have evaluated the use of filtered and unfiltered ground water samples. Based on this evaluation, OERR is issuing this guidance to state a strong preference for unfiltered ground water samples from monitoring wells.

Current research suggests that unfiltered samples are most representative and appropriately conservative for assessment-type work. The SAM, technical support personnel and hydrogeologists can use this guidance to establish site-specific data quality objectives and appropriate field techniques in the sampling work plan.

Field sampling personnel should consider and document all available sample collection options, before they decide to filter ground water samples taken from monitoring wells. If sample turbidity exceeds 10 NTU in spite of the best field collection methods, samplers may consider filtering with a 10 $\mu$ m filter. A sampler who chooses to filter under these conditions should provide a clear rationale for this decision in the field log book.

In order to select a sampling methodology the SAM should, as a minimum, consider the objectives of the sampling event, the purging/sampling techniques available, the geologic formation being sampled, and the contaminants of concern at the site.

This guidance is not meant to replace Regional SOPs, but to assist SAMs in collecting quality ground water samples. The site assessment program recommends that all site assessment managers and sampling professionals keep abreast of ongoing research on new ground water sampling techniques that could improve sample quality.

## DRAFT GUIDANCE

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**APPENDIX E**

**USEPA CONTRACT**

**LABORATORY PROGRAM**

**GUIDANCE**



## Multi-Media, Multi-Concentration, Inorganic Analytical Service for Superfund (ILM04.1)\*

Office of Emergency and Remedial Response  
Analytical Operations/Data Quality Center (5204G)

Quick Reference Fact Sheet

Under the legislative authority granted to the U.S. Environmental Protection Agency (EPA) under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA), EPA develops standardized analytical methods for the measurement of various pollutants in environmental samples from known or suspected hazardous waste sites. Among the pollutants that are of concern to EPA at such sites are a series of inorganic analytes and cyanide that are analyzed using inductively coupled plasma (ICP), atomic absorption (AA), and colorimetric techniques. The Analytical Operations/Data Quality Center (AOC) of the Office of Emergency and Remedial Response (OERR) offers an analytical service that provides data from the analysis of water and soil/sediment samples for inorganic analytes for use in the Superfund decision-making process. Through a series of standardized procedures and a strict chain-of-custody, the inorganic analytical service produces data of known and documented quality. This service is available through the Superfund Contract Laboratory Program (CLP).

### DESCRIPTION OF SERVICES

The inorganic analytical service provides a technical and contractual framework for laboratories to utilize EPA CLP analytical methods. These methods are used in the preparation, detection, and quantitative measurement of cyanide and 23 inorganic target analytes in both water and soil/sediment environmental samples. The CLP provides the methods to be used and the specific technical, reporting, and contractual requirements, including quality assurance, quality control, and standard operating procedures, by which EPA evaluates the data. This service uses ICP, AA, and colorimetric methods to analyze the inorganic target analytes and cyanide. Three data delivery turnarounds are available to CLP customers: 7, 14, and 21-day turnaround after receipt of the last sample in the set. In addition, a 72-hour preliminary data submission option also is available for all turnaround times.

### DATA USES

This analytical service provides data that EPA uses for a variety of purposes. Examples include determining the

nature and extent of contamination at a hazardous waste site, assessing priorities for response based on risks to human health and the environment, determining appropriate cleanup actions, and determining when remedial actions are complete. The data may be used in all stages in the investigation of a hazardous waste site including site inspections, Hazard Ranking System scoring, remedial investigations/feasibility studies, remedial design, treatability studies, and removal actions. In addition, this service provides data that are available for use in Superfund enforcement/litigation activities.

### TARGET ANALYTES

The analytes and detection limits for which this service is applicable are listed in **Table 1**. The list of target analytes for this service was originally derived from the EPA Priority Pollutant List of 129 compounds. In the years since the inception of the CLP, analytes have been added to and deleted from the Target Analyte List, based on advances in analytical methods, evaluation of method performance data, and the needs of the Superfund program. Specific detection limits are highly matrix dependent.

\* ILM04.1 is an interim inorganic analytical service. Further changes are expected to be released under ILM05.0 for competition during calendar year 2000.



**Table 1.**  
**Target Analyte List and Contract Required**  
**Detection Limits (CRDLs) (ILM04.1)**

Abbreviation	Analyte	CRDL <sup>1</sup> (µg/L)
Al	Aluminum	200
Sb	Antimony	60
As	Arsenic	10
Ba	Barium	200
Be	Beryllium	5
Cd	Cadmium	5
Ca	Calcium	5000
Cr	Chromium	10
Co	Cobalt	50
Cu	Copper	25
Fe	Iron	100
Pb	Lead	3
Mg	Magnesium	5000
Mn	Manganese	15
Hg	Mercury	0.2
Ni	Nickel	40
K	Potassium	5000
Se	Selenium	5
Ag	Silver	10
Na	Sodium	5000
Tl	Thallium	10
V	Vanadium	50
Zn	Zinc	20
Cn	Cyanide	10

Sample concentration exceeding five times the detection limit of the instrument or method in use may be reported even though the instrument or method detection limit is greater than the CRDL.

This is illustrated in the following example:

For lead:

Method in use = ICP

Instrument Detection Limit (IDL) = 40

Sample Concentration = 220

CRDL = 3

<sup>1</sup>The CRDL is the instrument detection limit obtained in pure water.

## METHODS AND INSTRUMENTATION

When storing samples, the use of a cooler temperature indicator bottle and the cooler temperature must be reported on Form DC-1 and in the Sample Delivery Group (SDG) Narrative. When applying AA methods, the Contractor may analyze the sample at a dilution so long as the raw concentration or absorbance of the diluted sample falls within the upper half of the calibration range. For ICP, an undiluted analysis of the sample is required.

If an insufficient sample amount (less than 90% of the required amount) is received to perform the analyses, the Contractor must contact the Sample Management Office (SMO) to report the problem. The same is required for multi-phase samples (e.g., two-phase liquid sample and oily sludge/sandy soil sample).

Table 2 summarizes the methods and instruments used in this analytical service.

## DATA DELIVERABLES

Data deliverables for this service include both hardcopy electronic data reporting forms and supporting raw data.

The laboratory must submit data to EPA within 7, 14, 21-days, or preliminary data must be submitted within 72 hours after laboratory receipt of each sample in the set. EPA then processes the data through an automated Data Assessment Tool (DAT). DAT is a complete CLP data assessment package. DAT incorporates Contract Compliance Screening (CCS) and Computer-Aided Data Review and Evaluation (CADRE) to provide EPA Regions with PC-compatible reports, spreadsheets, and electronic files. These files can be provided to the Regions within 24 to 48 hours from the receipt of the data and can be used as a tool during the data validation process at the Region. This automated tool facilitates the transfer of analytical data into Regional databases. In addition to the Regional electronic reports, the CLP laboratories are provided with a data assessment report that documents the instances of noncompliance. The laboratory has 4 days to reconcile defective data and resubmit the data to EPA. EPA then reviews the data for noncompliance and sends a final data assessment report to the CLP laboratory and the Region.

## QUALITY ASSURANCE

The quality assurance (QA) process consists of management review and oversight at the planning, implementation, and completion stages of the environmental data collection activity. This process ensures that the data provided are of the quality required.

**Table 2. Methods and Instruments**

Analyte	Instrument	Method
Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Ni, K, Se, Ag, Na, Tl, V, Zn	Inductively Coupled Plasma (ICP)	Acid digestion followed by ICP analysis
As, Pb, Tl, Se	Graphite Furnace Atomic Absorption (GFAA)	Acid digestion followed by GFAA analysis
Ca, Mg, Na, K	Flame Atomic Absorption (FAA)	Acid digestion followed by FAA analysis
Hg	Cold Vapor Atomic Absorption (CVAA)	Acid and permanganate oxidation followed by CVAA analysis
CN	Manual and Semi-automated Colorimetric	Distillation followed by colorimetric analysis

**Table 3. Quality Control**

QC Operation	Frequency
Instrument Calibration	Daily or each time instrument is set up
Initial Calibration Verification	Following each instrument calibration
Initial Calibration Blank	Following each instrument calibration
Continuing Calibration Verification	Every 10 analytical samples or every 2 hours during a run and at the beginning and end of each run
Continuing Calibration Blank	Every 10 analytical samples or every 2 hours during a run and at the beginning and end of each run
Interference Check Sample	Every 20 analytical samples and at the beginning and end of each run
CRDL Standard for ICP	Every 20 analytical samples and at the beginning and end of each run
CRDL Standard for AA	At the beginning of each AA analytical run
Serial Dilution for ICP	For each matrix type and concentration level for each SDG
Preparation Blank	For each sample preparation, analysis, and matrix per batch of prepared samples
Laboratory Control Sample	For each sample preparation and analysis procedure for each batch
Matrix Spike Sample Analysis	For each matrix type, concentration level, and method for each SDG
Duplicate Sample Analysis	For each matrix type, concentration level, and method for each SDG
Post Digestion Spike	Each time matrix spike recovery is outside QC limits
Analytical Spike	For each analytical sample analyzed by furnace AA
Method of Standard Addition	When the analytical spike recovery is outside QC limits
Instrument Detection Limit Determination	Quarterly
Interelement Corrections	Annually for ICP instruments only
Linear Range Analysis	Quarterly for ICP instruments only

During the data collection effort, QA activities ensure that the quality control (QC) system is functioning effectively and that the deficiencies uncovered by the QC system are corrected. After environmental data are collected, QA activities focus on assessing the quality of data to determine its suitability to support enforcement or remedial decisions. Each contract laboratory prepares a quality assurance plan (QAP) with the objective of providing sound analytical chemical measurements. The QAP must specify the policies, organization, objectives, functional guidelines, and QA/QC activities designed to achieve the data quality requirements for this analytical service.

#### **QUALITY CONTROL**

The QC process includes those activities required during analytical data collection to produce data of known and documented quality. The analytical data acquired from QC procedures are used to estimate and evaluate the analytical results and to determine the necessity for, or the effect of, corrective action procedures. The QC procedures required for this analytical service are shown in **Table 3**.

#### **PERFORMANCE MONITORING ACTIVITIES**

Laboratory performance monitoring activities are provided primarily by AOC and the Regions to ensure that contract laboratories are producing data of the appropriate quality. EPA performs on-site laboratory audits, data package audits, and evaluates laboratory performance through the use of blind performance evaluation samples.

For more information, or for suggestions to improve this analytical service, please contact:

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## Low Concentration Organic Analytical Service for Superfund (Water Matrix) (OLC03.2)

Office of Emergency and Remedial Response  
Analytical Operations/Data Quality Center (5204G)

Quick Reference Fact Sheet

Under the legislative authority granted to the U.S. Environmental Protection Agency (EPA) under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA), EPA develops standardized analytical methods for the measurement of various pollutants in environmental samples from known or suspected hazardous waste sites. Among the pollutants that are of concern to the EPA at such sites are a series of volatile, semivolatile, and pesticide/Aroclor (pesticide/PCB) compounds that are analyzed using Gas Chromatography coupled with Mass Spectrometry (GC/MS) and Gas Chromatography with an Electron Capture Detector (GC/ECD). The Analytical Operations/Data Quality Center (AOC) of the Office of Emergency and Remedial Response (OERR) offers an analytical service that provides data from the analysis of water samples for low concentration organic compounds for use in the Superfund decision-making process. Through a series of standardized procedures and a strict chain-of-custody, the low concentration organic analytical service produces data of known and documented quality. This service is available through the Superfund Contract Laboratory Program (CLP).

### DESCRIPTION OF SERVICES

The low concentration organic analytical service provides a contractual framework for laboratories to apply EPA/CLP analytical methods for the isolation, detection, and quantitative measurement of 50 volatile, 65 semivolatile, and 28 pesticide/Aroclor (pesticide/PCB) target compounds in water samples. The analytical service provides the methods to be used and the specific contractual requirements, by which EPA evaluates the data. The options for data turnaround time for this contract are 7, 14, or 21 days after laboratory receipt of the last sample in the Sample Delivery Group (SDG). This service uses Gas Chromatography/Mass Spectrometry (GC/MS) and Gas Chromatography with Electron Capture Detector (GC/ECD) techniques to analyze the target compounds.

### DATA USES

This analytical service provides data that EPA uses for a variety of purposes such as: determining the nature and extent of contamination at a hazardous waste site; assessing priorities for response based on risks to human health and the environment; determining appropriate cleanup actions; and determining when remedial actions are complete. The data may be used at all stages in the investigation of hazardous waste sites including: site inspections; Hazard Ranking

System (HRS) scoring; remedial investigation/feasibility studies; remedial design; treatability studies; and removal actions. In addition, this service provides data that are available for use in Superfund enforcement/litigation activities.

### TARGET COMPOUNDS

The compounds and quantitation limits for which this service is applicable are listed in **Table 1**. The lowest reportable quantitation limits are 0.50 µg/L for the volatile compounds, 5.0 µg/L for the semivolatile compounds, and 0.01 µg/L for the pesticide/Aroclor compounds. The list of target compounds for this service was originally derived from the EPA Priority Pollutant List of 129 compounds. In the years since the inception of the CLP, compounds have been added to and deleted from the Target Compound List (TCL), based on advances in analytical methods, evaluation of method performance data, and the needs of the Superfund program.

### METHODS AND INSTRUMENTATION

For volatiles, 25 mL of sample is added to a purge-and-trap device. A solution of 14 Deuterated Monitoring Compounds (DMCs) and a solution of internal standards are added to the sample which is then purged with an inert gas at room temperature.

**Table 1. Target Compound List and Contract Required Quantitation Limits (CROQLs) in µg/L (OLC03.2)**

VOLATILES		Quantitation Limits µg/L	SEMIVOLATILES		Quantitation Limits µg/L			Quantitation Limits µg/L
1.	Dichlorodifluoromethane	0.5	51.	Benzaldehyde	5	101.	Di-n-butylphthalate	5
2.	Chloromethane	0.5	52.	Phenol	5	102.	Fluoranthene	5
3.	Vinyl Chloride	0.5	53.	bis-(2-Chloroethyl) ether	5	103.	Pyrene	5
4.	Bromomethane	0.5	54.	2-Chlorophenol	5	104.	Butylbenzylphthalate	5
5.	Chloroethane	0.5	55.	2-Methylphenol	5	105.	3,3'-Dichlorobenzidine	5
6.	Trichlorofluoromethane	0.5	56.	2,2'-oxybis (1-Chloropropane) <sup>1</sup>	5	106.	Benzo(a)anthracene	5
7.	1,1-Dichloroethene	0.5	57.	Acetophenone	5	107.	Chrysene	5
8.	1,1,2-Trichloro-1,2,2-trifluoromethane	0.5	58.	4-Methylphenol	5	108.	bis-(2-Ethylhexyl) phthalate	5
9.	Acetone	5	59.	N-Nitroso-di-n-propylamine	5	109.	Di-n-octylphthalate	5
10.	Carbon Disulfide	0.5	60.	Hexachloroethane	5	110.	Benzo(b)fluoranthene	5
11.	Methyl Acetate	0.5	61.	Nitrobenzene	5	111.	Benzo(k)fluoranthene	5
12.	Methylene Chloride	0.5	62.	Isophorone	5	112.	Benzo(a)pyrene	5
13.	trans-1,2-Dichloroethene	0.5	63.	2-Nitrophenol	5	113.	Indeno(1,2,3-cd)pyrene	5
14.	Methyl tert-Butyl Ether	0.5	64.	2,4-Dimethylphenol	5	114.	Dibenzo(a,h)anthracene	5
15.	1,1-Dichloroethane	0.5	65.	bis (2-Chloroethoxy) methane	5	115.	Benzo(g,h,i)perylene	5
16.	cis-1,2-Dichloroethene	0.5	66.	2,4-Dichlorophenol	5	<b>PESTICIDES/AROCLORS</b> <b>(PESTICIDES/PCBs)</b>		
17.	2-Butanone	5	67.	Naphthalene	5			
18.	Bromochloromethane	0.5	68.	4-Chloroaniline	5	116.	alpha-BHC	0.01
19.	Chloroform	0.5	69.	Hexachlorobutadiene	5	117.	beta-BHC	0.01
20.	1,1,1-Trichloroethane	0.5	70.	Caprolactam	5	118.	delta-BHC	0.01
21.	Cyclohexane	0.5	71.	4-Chloro-3-methylphenol	5	119.	gamma-BHC (Lindane)	0.01
22.	Carbon Tetrachloride	0.5	72.	2-Methylnaphthalene	5	120.	Heptachlor	0.01
23.	Benzene	0.5	73.	Hexachlorocyclopentadiene	5	121.	Aldrin	0.01
24.	1,2-Dichloroethane	0.5	74.	2,4,6-Trichlorophenol	5	122.	Heptachlor epoxide <sup>2</sup>	0.01
25.	Trichloroethene	0.5	75.	2,4,5-Trichlorophenol	20	123.	Endosulfan I	0.01
26.	Methyleyclohexane	0.5	76.	1,1'-Biphenyl	5	124.	Dieldrin	0.02
27.	1,2-Dichloropropane	0.5	77.	2-Chloronaphthalene	5	125.	4,4'-DDE	0.02
28.	Bromodichloromethane	0.5	78.	2-Nitroaniline	20	126.	Endrin	0.02
29.	cis-1,3-Dichloropropene	0.5	79.	Dimethylphthalate	5	127.	Endosulfan II	0.02
30.	4-Methyl-2-pentanone	5	80.	2,6-Dinitrotoluene	5	128.	4,4'-DDD	0.02
31.	Toluene	0.5	81.	Acenaphthylene	5	129.	Endosulfan sulfate	0.02
32.	trans-1,3-Dichloropropene	0.5	82.	3-Nitroaniline	20	130.	4,4'-DDT	0.02
33.	1,1,2-Trichloroethane	0.5	83.	Acenaphthene	5	131.	Methoxychlor	0.10
34.	Tetrachloromethane	0.5	84.	2,4-Dinitrophenol	20	132.	Endrin ketone	0.02
35.	2-Hexanone	5	85.	4-Nitrophenol	20	133.	Endrin aldehyde	0.02
36.	Dibromochloromethane	0.5	86.	Dibenzofuran	5	134.	alpha-Chlordane	0.01
37.	1,2-Dibromoethane	0.5	87.	2,4-Dinitrotoluene	5	135.	gamma-Chlordane	0.01
38.	Chlorobenzene	0.5	88.	Diethylphthalate	5	136.	Toxaphene	1.0
39.	Ethylbenzene	0.5	89.	Fluorene	5	137.	Aroclor-1016	0.20
40.	Xylenes (total)	0.5	90.	4-Chlorophenyl-phenylether	5	138.	Aroclor-1221	0.40
41.	Styrene	0.5	91.	4-Nitroaniline	20	139.	Aroclor-1232	0.20
42.	Bromoform	0.5	92.	4,6-Dinitro-2-methylphenol	20	140.	Aroclor-1242	0.20
43.	Isopropylbenzene	0.5	93.	N-Nitrosodiphenylamine	5	141.	Aroclor-1248	0.20
44.	1,1,2,2-Tetrachloroethane	0.5	94.	1,2,4,5-Tetrachlorobenzene	5	142.	Aroclor-1254	0.20
45.	1,3-Dichlorobenzene	0.5	95.	4-Bromophenyl-phenylether	5	143.	Aroclor-1260	0.20
46.	1,4-Dichlorobenzene	0.5	96.	Hexachlorobenzene	5			
47.	1,2-Dichlorobenzene	0.5	97.	Atrazine	5			
48.	1,2-Dibromo-3-chloropropane	0.5	98.	Pentachlorophenol	5			
49.	1,2,4-Trichlorobenzene	0.5	99.	Phenanthrene	5			
50.	1,2,3-Trichlorobenzene	0.5	100.	Anthracene	5			

<sup>1</sup>Previously known by the name bis (2-chloroisopropyl) ether.

<sup>2</sup>Only the exo-epoxy isomer (isomer B) of heptachlor epoxide is reported on the data reporting forms.

The volatiles purged from the sample are trapped on a solid sorbent. They are subsequently desorbed into a GC/MS system.

For semivolatile and pesticide/Aroclor water samples, a 1-L aliquot is extracted with methylene chloride using continuous liquid-liquid extraction or a separatory funnel (for pesticides/Aroclors only). For pesticide/Aroclors, the aliquot is spiked with a solution of two surrogate compounds before extraction. The

extract is dried, concentrated, and subjected to cleanup prior to GC/ECD analysis. For semivolatiles, the aliquot is acidified to a pH of 2.0 and a solution of 16 DMCS is added before extraction. The extract is dried and concentrated, internal standards are added, and then it is analyzed by GC/MS. Table 2 summarizes the preparation methods and instruments used in this analytical service.

## DATA DELIVERABLES

Data deliverables for this service include hardcopy data reporting forms, supporting raw data, and electronic data on diskette or other means specified by EPA. The laboratory must submit data to EPA within 7, 14, or 21 days after laboratory receipt of the last sample in the SDG. EPA then checks the data for compliance with contract requirements. A report of instances of noncompliance is distributed to the laboratory and the Region within 7 days from the receipt of the data. The laboratory has 7 days from receipt of the report to reconcile defective data and resubmit the data to EPA. EPA then screens the data and sends a final data assessment report to the laboratory and the Region.

## QUALITY ASSURANCE

The Quality Assurance (QA) process consists of management review and oversight at the planning, implementation, and completion stages of the environmental data collection activity. This process ensures that the data provided are of the quality required.

During the implementation of the data collection effort, QA activities ensure that the Quality Control (QC) system is functioning effectively and that the deficiencies uncovered by the QC system are corrected. After environmental data are collected, QA activities focus on assessing the quality of data to determine its

suitability to support enforcement or remedial decisions. Each contract laboratory prepares a Quality Assurance Plan (QAP) with the objective of providing sound analytical chemical measurements. The QAP must specify the policies, organization, objectives, and functional guidelines, as well as the QA/QC activities designed to achieve the data quality requirements for this analytical service.

## QUALITY CONTROL

The QC process includes those activities required during analytical data collection to produce data of known and documented quality. The analytical data acquired from QC procedures are used to estimate and evaluate the analytical results and to determine the necessity for, or the effect of, corrective action procedures. The QC requirements for this analytical service are shown in Table 3.

## PERFORMANCE MONITORING ACTIVITIES

Laboratory performance monitoring activities are provided primarily by AOC and the Regions to ensure that contract laboratories are producing data of the appropriate quality. EPA performs on-site laboratory audits, data package audits, and GC/MS tape audits, and evaluates laboratory performance through the use of blind PE samples.

**Table 2. Methods and Instruments**

Fraction	Preparation Method	Analytical Instrument
Volatiles	Purge-and-trap	GC/MS analysis
Semivolatiles	Continuous liquid-liquid extraction	GC/MS analysis
Pesticides/Aroclors (Pesticides/PCBs)	Continuous liquid-liquid or separatory funnel extraction	GC/ECD analysis

**Table 3. Quality Control**

QC Operation	Frequency
Deuterated Monitoring Compounds (DMCs) (volatiles and semivolatiles)	Added to each sample, standard, and blank.
Method Blanks (volatiles)	Analyzed at least every 12 hours.
Method Blanks [semivolatiles and pesticides/Aroclors (pesticides/PCBs)]	Prepared with each group of 20 field samples or less, or each time samples are extracted.
Instrument Blank (volatiles)	Analyzed after a sample that contains compounds at concentrations greater than the calibration range.
Instrument Blank [pesticides/Aroclors (pesticides/PCBs)]	Every 12 hours and preceding all groups of acceptable sample analysis.
Surrogates [pesticides/Aroclors (pesticides/PCBs)]	Added to each sample, standard, and blank.

**Table 3. Quality Control (Continued)**

QC Operation	Frequency
Storage Blank (volatiles)	Prepared and stored with each group of samples. Analyzed after all samples in the SDG have been analyzed.
Instrument Performance Check (volatiles and semivolatiles)	Prior to any analysis and every 12 hours.
GC Resolution Check [pesticides/Aroclors (pesticides/PCBs)]	Prior to initial calibration on each GC column used for analysis.
Initial Calibration	Upon initial set up of each instrument, after major instrument maintenance or modification, and each time continuing calibration fails to meet the acceptance criteria.
Continuing Calibration (volatiles and semivolatiles)	Every 12 hours for each instrument used for analysis.
Calibration Verification [pesticides/Aroclor (pesticides/PCBs)]	Beginning and end of each 12-hour data collection period.
Internal Standards (volatiles and semivolatiles)	Added to each sample, standard, and blank.
Laboratory Control Sample (LCS) [pesticides/Aroclor (pesticides/PCBs)]	Prepared and analyzed once per SDG.
Performance Evaluation (PE) Sample	Prepared and analyzed (if provided) with every 20 field samples in an SDG or for each SDG, whichever is most frequent.
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	Performed only when requested by Region. Performed with every 20 field samples in an SDG or for each SDG, whichever is most frequent.
Method Detection Limit (MDL)	Run before any samples analyzed under contract (annually thereafter) and after major instrument maintenance.
Sulfur Cleanup Blank [pesticides/Aroclor (pesticides/PCBs)]	Only when part of a set of samples extracted together requires sulfur removal.
Sample Cleanup by Florisil Cartridge	Performed on all sample extracts and method blank extracts.
Florisil Cartridge Performance Check [pesticides/Aroclor (pesticides/PCBs)]	Performed at least once on each lot of cartridges used for sample cleanup or every 6 months, whichever is most frequent.

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# Multi-Media, Multi-Concentration, Organic Analytical Service for Superfund (OLM04.2)

Office of Emergency and Remedial Response  
Analytical Operations/Data Quality Center (5204G)

Quick Reference Fact Sheet

Under the legislative authority granted to the U.S. Environmental Protection Agency (EPA) under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA), EPA develops standardized analytical methods for the measurement of various pollutants in environmental samples from known or suspected hazardous waste sites. Among the pollutants that are of concern to the EPA at such sites, are a series of volatile, semivolatile, and pesticide/Aroclor (pesticide/PCB) compounds that are analyzed using gas chromatography coupled with mass spectrometry (GC/MS) and gas chromatography with an electron capture detector (GC/ECD). The Analytical Operations/Data Quality Center (AOC) of the Office of Emergency and Remedial Response (OERR) offers an analytical service that provides data from the analysis of water and soil/sediment samples for organic compounds for use in the Superfund decision-making process. Through a series of standardized procedures and a strict chain-of-custody, the organic analytical service produces data of known and documented quality. This service is available through the Superfund Contract Laboratory Program (CLP).

## DESCRIPTION OF SERVICES

The new organic analytical service is available as of September 1999. It provides a technical and contractual framework for laboratories to apply EPA/CLP analytical methods for the isolation, detection, and quantitative measurement of 48 volatile, 65 semivolatile, and 28 pesticide/Aroclor (pesticide/PCB) target compounds in water and soil/sediment environmental samples. The CLP provides the methods to be used and the specific technical, reporting, and contractual requirements, including quality assurance (QA), quality control (QC), and standard operating procedures (SOPs), by which EPA evaluates the data. This service uses GC/MS and GC/ECD methods to analyze the target compounds. Three data delivery turnarounds are available to CLP customers: 7, 14, and 21-day turnaround after laboratory receipt of the last sample in the set. In addition, there are 48 (for volatiles) and 72-hour [for semivolatiles and pesticides/Aroclors (pesticides/PCBs)] preliminary data submission options available. New options under this service include a closed system purge-and-trap method for low level volatile soil analysis and methanol preservation for medium level volatile soil analysis. In addition, users may request modifications to the specified methodologies that may include, but are not limited to, additional compounds and modified quantitation limits. A flexibility clause is also available to data users to submit samples using modified analyses to meet specific field requirements. These requirements include modified lower "California level"

quantitation limits, additional analytes, and requirements to enhance method performance.

## DATA USES

This analytical service provides data which EPA uses for a variety of purposes, such as determining the nature and extent of contamination at a hazardous waste site, assessing priorities for response based on risks to human health and the environment, determining appropriate cleanup actions, and determining when remedial actions are complete. The data may be used in all stages in the investigation of a hazardous waste site including site inspections, Hazard Ranking System scoring, remedial investigations/feasibility studies, remedial design, treatability studies, and removal actions. In addition, this service provides data that will be available for use in Superfund enforcement/litigation activities.

## TARGET COMPOUNDS

The compounds for which this service is applicable and the corresponding quantitation limits are listed in **Table 1**. For water samples, the lowest quantitation limits reportable are 10 ppb for the volatile compounds, 10 ppb for the semivolatile compounds, and 0.05 ppb for the pesticide/Aroclor (pesticide/PCB) compounds. For soil samples, the lowest quantitation limits reportable are 10 ppb for the volatile compounds, 330 ppb for the semivolatile compounds, and 1.7 ppb for the pesticide/Aroclor



**Table 1. Target Compound List and Contract Required Quantitation Limits (CROLs) For OLM04.2\***

Quantitation Limits				Quantitation Limits				Quantitation Limits			
			Modified				Low				Low
Water			Cal. <sup>1</sup>	Water			Soil	Water			Soil
(µg/L)	(µg/Kg)	(µg/L)		(µg/L)	(µg/Kg)			(µg/L)	(µg/L)	(µg/Kg)	(µg/Kg)
<b>VOLATILES</b>				<b>SEMIVOLATILES</b>				<b>PESTICIDES/AROCLORS</b>			
1. Dichlorodifluoromethane	10	10	0.50	49. Benzaldehyde	10	330		98. Carbazole	10	330	
2. Chloromethane	10	10	0.50	50. Phenol	10	330		99. Di-n-butylphthalate	10	330	
3. Vinyl Chloride	10	10	0.50	51. bis-(2-Chloroethyl) ether	10	330		100. Fluoranthene	10	330	
4. Bromomethane	10	10	0.50	52. 2-Chlorophenol	10	330		101. Pyrene	10	330	
5. Chloroethane	10	10	0.50	53. 2-Methylphenol	10	330		102. Butylbenzylphthalate	10	330	
6. Trichlorofluoromethane	10	10	0.50	54. 2,2'-oxybis				103. 3,3'-Dichlorobenzidine	10	330	
7. 1,1-Dichloroethene	10	10	0.50	(1-Chloropropane)	10	330		104. Benzo(a)anthracene	10	330	
8. 1,1,2-Trichloro-				55. Acetophenone	10	330		105. Chrysene	10	330	
1,2,2-trifluoroethane	10	10	0.50	56. 4-Methylphenol	10	330		106. bis-(2-Ethylhexyl)phthalate	10	330	
9. Acetone	10	10	10	57. N-Nitroso-di-n-propylamine	10	330		107. Di-n-octylphthalate	10	330	
10. Carbon Disulfide	10	10	0.50	58. Hexachloroethane	10	330		108. Benzo(b)fluoranthene	10	330	
11. Methyl Acetate	10	10	0.50	59. Nitrobenzene	10	330		109. Benzo(k)fluoranthene	10	330	
12. Methylene Chloride	10	10	0.50	60. Isophorone	10	330		110. Benzo(a)pyrene	10	330	
13. trans-1,2-Dichloroethene	10	10	0.50	61. 2-Nitrophenol	10	330		111. Indeno(1,2,3-cd)pyrene	10	330	
14. Methyl tert-Butyl Ether	10	10	0.50	62. 2,4-Dimethylphenol	10	330		112. Dibenzo(a,h)anthracene	10	330	
15. 1,1-Dichloroethane	10	10	0.50	63. bis-(2-Chloroethoxy) methane	10	330		113. Benzo(g,h,i)perylene	10	330	
16. cis-1,2-Dichloroethene	10	10	0.50	64. 2,4-Dichlorophenol	10	330		<b>PESTICIDES/PCBS</b>			
17. 2-Butanone	10	10	10	65. Naphthalene	10	330					
18. Chloroform	10	10	0.50	66. 4-Chloroaniline	10	330		Water	Soil		
19. 1,1,1-Trichloroethane	10	10	0.50	67. Hexachlorobutadiene	10	330		(µg/L)	(µg/Kg)		
20. Cyclohexane	10	10	0.50	68. Caprolactam	10	330		114. alpha-BHC	0.05	1.7	
21. Carbon Tetrachloride	10	10	0.50	69. 4-Chloro-3-methylphenol	10	330		115. beta-BHC	0.05	1.7	
22. Benzene	10	10	0.50	70. 2-Methylnaphthalene	10	330		116. delta-BHC	0.05	1.7	
23. 1,2-Dichloroethane	10	10	0.50	71. Hexachlorocyclopentadiene	10	330		117. gamma-BHC (Lindane)	0.05	1.7	
24. Trichloroethene	10	10	0.50	72. 2,4,6-Trichlorophenol	10	330		118. Heptachlor	0.05	1.7	
25. Methylcyclohexane	10	10	0.50	73. 2,4,5-Trichlorophenol	25	830		119. Aldrin	0.05	1.7	
26. 1,2-Dichloropropane	10	10	0.50	74. 1,1'-Biphenyl	10	330		120. Heptachlor epoxide	0.05	1.7	
27. Bromodichloromethane	10	10	0.50	75. 2-Chloronaphthalene	10	330		121. Endosulfan I	0.05	1.7	
28. cis-1,3-Dichloropropene	10	10	0.50	76. 2-Nitroaniline	25	830		122. Dieldrin	0.10	3.3	
29. 4-Methyl-2-pentanone	10	10	10	77. Dimethylphthalate	10	330		123. 4,4'-DDE	0.10	3.3	
30. Toluene	10	10	0.50	78. 2,6-Dimethyltoluene	10	330		124. Endrin	0.10	3.3	
31. trans-1,3-Dichloropropene	10	10	0.50	79. Acenaphthylene	10	330		125. Endosulfan II	0.10	3.3	
32. 1,1,2-Trichloroethane	10	10	0.50	80. 3-Nitroaniline	25	830		126. 4,4'-DDD	0.10	3.3	
33. Tetrachloroethene	10	10	0.50	81. Acenaphthene	10	330		127. Endosulfan sulfate	0.10	3.3	
34. 2-Hexanone	10	10	10	82. 2,4-Dinitrophenol	25	830		128. 4,4'-DDT	0.10	3.3	
35. Dibromochloromethane	10	10	0.50	83. 4-Nitrophenol	25	830		129. Methoxychlor	0.50	17	
36. 1,2-Dibromoethane	10	10	0.50	84. Dibenzofuran	10	330		130. Endrin ketone	0.10	3.3	
37. Chlorobenzene	10	10	0.50	85. 2,4-Dinitrotoluene	10	330		131. Endrin aldehyde	0.10	3.3	
38. Ethylbenzene	10	10	0.50	86. Diethylphthalate	10	330		132. alpha-Chlordane	0.05	1.7	
39. Xylenes (Total)	10	10	0.50	87. Fluorene	10	330		133. gamma-Chlordane	0.05	1.7	
40. Styrene	10	10	0.50	88. 4-Chlorophenyl-phenylether	10	330		134. Toxaphene	5.0	170	
41. Bromoform	10	10	0.50	89. 4-Nitraniline	25	830		135. Aroclor-1016	1.0	33	
42. Isopropylbenzene	10	10	0.50	90. 4,6-Dinitro-2-methylphenol	25	830		136. Aroclor-1221	2.0	67	
43. 1,1,2,2-Tetrachloroethane	10	10	0.50	91. N-Nitrosodiphenylamine	10	330		137. Aroclor-1232	1.0	33	
44. 1,3-Dichlorobenzene	10	10	0.50	92. 4-Bromophenyl-phenylether	10	330		138. Aroclor-1242	1.0	33	
45. 1,4-Dichlorobenzene	10	10	0.50	93. Hexachlorobenzene	10	330		139. Aroclor-1248	1.0	33	
46. 1,2-Dichlorobenzene	10	10	0.50	94. Atrazine	10	330		140. Aroclor-1254	1.0	33	
47. 1,2-Dibromo-				95. Pentachlorophenol	25	830		141. Aroclor-1260	1.0	33	
3-chloropropane	10	10	0.50	96. Phenanthrene	10	330					
48. 1,2,4-Trichlorobenzene	10	10	0.50	97. Anthracene	10	330					

\* For volatiles, quantitation limits for medium soils are approximately 100 to 125 times the quantitation limits for low soils. For semivolatile medium soils, quantitation limits are approximately 30 times the quantitation limits for low soils.

<sup>1</sup>Modified "California level" quantitation limits as available under the flexibility clause.

compounds. Specific sample quantitation limits will be highly matrix dependent. Compounds identified with concentrations below the quantitation limit will be reported as estimated concentration values.

The list of target compounds for this service was originally derived from the EPA Priority Pollutant List of 129 compounds. In the years since inception of the CLP, compounds have been added to and removed from the Target Compound List (TCL), based on advances in analytical methods, evaluation of method performance data, and the needs of the Superfund program.

For drinking water and groundwater type samples, use of the low concentration organic analytical service is recommended.

## METHODS AND INSTRUMENTATION

For semivolatile and pesticide/Aroclor (pesticide/PCB) water samples, a 1-L aliquot is extracted with methylene chloride using a continuous liquid-liquid extractor or separatory funnel [for pesticides/Aroclors (pesticides/PCBs) only]. For low level semivolatile soil and pesticide/Aroclor (pesticides/PCBs) soil samples, a 30-g soil/sediment sample is extracted with methylene chloride/acetone using sonication, automated soxhlet, or pressurized fluid extraction techniques. For medium level semivolatile soil samples, a 1-g aliquot is extracted with methylene chloride using the techniques mentioned above for low level soil samples. For both water and soil samples, the extract is concentrated, subjected to fraction-specific cleanup procedures, and analyzed by GC/MS for semivolatiles or GC/ECD for pesticides/Aroclors (pesticides/PCBs).

For volatile water samples, 5 mL of water is added to a purge and trap device and purged with an inert gas at room temperature. For volatile low level soil samples, a 5-g aliquot of soil is added to a purge and trap device with 5 mL of reagent water then purged with an inert gas at 40°C; or a 5-g aliquot (pre-weighed in the field) is purged from a closed-system purge and trap device at 40°C. For volatile medium level soil samples, a measured amount is collected/extracted with methanol and an aliquot of the methanol extract is added to reagent water and purged at room temperature. For both water and soil samples, the volatiles purged from the sample are trapped on a solid sorbent. They are subsequently desorbed by rapidly heating the sorbent and then introduced into a GC/MS system. Table 2 summarizes the methods and instruments used in this analytical service.

Under the flexibility clause, EPA is seeking current CLP laboratories to perform organic analysis through a modified analysis protocol. Some modifications include, but are not limited to, a reduced CRQL of 0.5 µg/L for all non-ketone compounds, modified calibration standards, as well as additional cleanup methods.

## DATA DELIVERABLES

Data deliverables for this service include hardcopy data reporting forms and supporting raw data. In addition to the hardcopy deliverable, contract laboratories must also submit the same data electronically. The laboratory must submit data to EPA within 7, 14, or 21-days [or preliminary data within 48 hours (for volatiles)] or 72 hours [for semivolatiles and pesticides/Aroclors (pesticides/PCBs)] after laboratory receipt of the last sample in the set. EPA then processes the data through an automated Data Assessment Tool (DAT). DAT is a complete CLP data assessment package. DAT incorporates Contract Compliance Screening (CCS) and Computer-Aided Data Review and Evaluation (CADRE) review to provide EPA Regions with PC-compatible reports, spreadsheets, and electronic files within 24 to 48 hours from the receipt of the data for data validation. This automated tool facilitates the transfer of analytical data into Regional databases. In addition to the Regional electronic reports, the CLP laboratories are provided with a data assessment report that documents the instances of noncompliance. The laboratory has 10 days to reconcile defective data and resubmit the data to EPA. EPA then reviews the data for noncompliance and sends a final data assessment report to the CLP laboratory and the Region.

## QUALITY ASSURANCE

The quality assurance (QA) process consists of management review and oversight at the planning, implementation, and completion stages of the environmental data collection activity. This process ensures that the data provided are of the quality required.

During the implementation of the data collection effort, QA activities ensure that the quality control (QC) system is functioning effectively and that the deficiencies uncovered by the QC system are corrected. After environmental data are collected, QA activities focus on assessing the quality of data to determine its suitability to support enforcement or remedial decisions.

Each contract laboratory prepares a quality assurance plan (QAP) with the objective of providing sound analytical chemical measurements. The QAP must specify the policies, organization, objectives, and functional guidelines, as well as the QA and QC activities designed to achieve the data quality requirements for this analytical service.

## QUALITY CONTROL

The QC process includes those activities required during analytical data collection to produce data of known and documented quality. The analytical data acquired from QC procedures are used to estimate and evaluate the analytical results and to determine the necessity for, or the effect of, corrective action procedures. The QC procedures required for this analytical service are shown in Table 3.

**Table 2. Methods and Instruments**

Fraction	Water	Soil
Volatiles	Purge-and-trap followed by GC/MS analysis	Purge-and-trap or closed-system purge-and-trap followed by GC/MS analysis
Semivolatiles	Continuous liquid-liquid extraction followed by GC/MS analysis	Sonication, automated soxhlet, or pressurized fluid extraction followed by GC/MS analysis
Pesticides/Aroclors (Pesticides/PCBs)	Continuous liquid-liquid or separatory funnel extraction followed by dual column GC/ECD analysis	Sonication, automated soxhlet or pressurized fluid extraction followed by dual column GC/ECD analysis

**Table 3. Quality Control**

QC Operation	Frequency
System Monitoring Compounds (volatiles)	Added to each sample, standard, and blank
Surrogates [for semivolatiles and pesticides Aroclors (pesticides/PCBs)]	Added to each sample, standard, and blank
Method Blanks (volatiles)	Analyzed at least every 12 hours for each matrix and level
Method Blanks [semivolatiles and pesticides/Aroclors (pesticides/PCBs)]	Prepared with each group of 20 samples or less of same matrix and level, or each time samples are extracted by the same procedure
Instrument Blank (volatiles)	Analyzed after a sample which contains compounds at concentrations greater than the calibration range
Instrument Blank [pesticides/Aroclors (pesticides/PCBs)]	Every 12 hours on each GC column used for analysis
Storage Blanks (volatiles)	Prepared and stored with each set of samples
GC/MS mass calibration and ion abundance patterns (volatiles and semivolatiles)	Every 12 hours for each instrument used for analysis
GC Resolution Check [pesticides/Aroclors (pesticides/PCBs)]	Prior to initial calibration, on each instrument used for analysis
Initial Calibration	Upon initial set up of each instrument, and each time continuing calibration fails to meet the acceptance criteria
Continuing Calibration	Every 12 hours for each instrument used for analysis
Internal Standards (volatiles and semivolatiles)	Added to each sample, standard, and blank
Matrix Spike and Matrix Spike Duplicate	Once every 20 or fewer samples of same fraction, matrix, and level in an SDG

**PERFORMANCE MONITORING ACTIVITIES**

Laboratory performance monitoring activities are provided primarily by AOC and the Regions to ensure that contract laboratories are producing data of the appropriate quality. EPA performs on-site laboratory audits, data package audits, GC/MS and/or GC/ECD tape audits, and evaluates laboratory performance through the use of blind performance evaluation samples.

For more information, or for suggestions to improve this analytical service, please contact:

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## Summary of Major Changes Made to the Low Concentration Organic Analytical Service for Superfund (Water Matrix) (OLC02.1 to OLC03.2)

Office of Emergency and Remedial Response  
Analytical Operations/Data Quality Center (5204G)

Quick Reference Fact Sheet

Under the legislative authority granted to the U.S. Environmental Protection Agency (EPA) under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA), EPA develops standardized analytical methods for the measurement of various pollutants in environmental samples from known or suspected hazardous waste sites. Among the pollutants that are of concern to EPA at such sites are a series of volatile, semivolatile, and pesticide/Aroclor (pesticide/PCB) compounds that are analyzed using Gas Chromatography coupled with Mass Spectrometry (GC/MS) and Gas Chromatography with an Electron Capture Detector (GC/ECD). The Analytical Operations/Data Quality Center (AOC) of the Office of Emergency and Remedial Response (OERR) offers an analytical service that provides data from the analysis of water samples for low concentration organic compounds for use in the Superfund decision-making process. Through a series of standardized procedures and a strict chain-of-custody, the low concentration organic analytical service produces data of known and documented quality. This service is available through the Superfund Contract Laboratory Program (CLP).

### OVERVIEW OF MAJOR CHANGES

The new low concentration organic analytical service provides a technical and contractual framework for laboratories to apply EPA/CLP analytical methods for the preparation, detection, and quantitative measurement of 50 volatile, 65 semivolatile, and 28 pesticide/Aroclor (pesticide/PCB) target compounds in water samples.

- i. All references to 14-day turnaround times were removed. With OLC03.2, laboratories now have 7-, 14-, or 21-day turnaround times for analyses after laboratory receipt of the last sample in the Sample Delivery Group (SDG).
- ii. Modified the number of days required for the distribution of noncompliance reports to laboratories from 10 to 7 days after data receipt.
- iii. The number of volatile and semivolatile compounds has been modified to include nine new volatile compounds and six new semivolatile compounds. The compounds that have been added are detailed in the **Modifications to Target Compounds** section and are shaded in Table 1.

- iv. Laboratories are now required to submit a computer-readable copy of the data contained within data reporting forms on high-density diskettes or via alternate means of electronic transmission approved in advance by EPA. The specifications of the electronic deliverable formats are detailed in Exhibit H. Delivery will be as specified in the laboratory Contract.
- v. Preliminary results may be requested through this analytical service, as detailed in Exhibit B. Preliminary results consist of Form I and Form I-TIC analytical results, by fraction, for field and Quality Control (QC) samples, submitted via telefacsimile or email upon prior approval by EPA.
- vi. Laboratories may be requested to perform modified analyses, as detailed in Exhibit A. The modifications will be within the scope of the SOW and may include, but are not limited to, analysis of additional analytes and/or lower quantitation limits.

### MODIFICATION TO TARGET COMPOUNDS

Since the CLP began in 1980, compounds have been added and removed from the Target Compound List

**Table 1. Target Compound List and Contract Required Quantitation Limits (CROLs) in µg/L (OLC03.2)**

VOLATILES		Quantitation Limits µg/L	SEMIVOLATILES		Quantitation Limits µg/L			Quantitation Limits µg/L
1.	Dichlorodifluoromethane	0.5	51.	Benzaldehyde	5	101.	Di-n-butylphthalate	5
2.	Chloromethane	0.5	52.	Phenol	5	102.	Fluoranthene	5
3.	Vinyl Chloride	0.5	53.	bis-(2-Chloroethyl)ether	5	103.	Pyrene	5
4.	Bromomethane	0.5	54.	2-Chlorophenol	5	104.	Butylbenzylphthalate	5
5.	Chloroethane	0.5	55.	2-Methylphenol	5	105.	3,3'-Dichlorobenzidine	5
6.	Trichlorofluoromethane	0.5	56.	2,2'-oxybis(1-Chloropropane)	5	106.	Benzo(a)anthracene	5
7.	1,1-Dichloroethene	0.5	57.	Acetophenone	5	107.	Chrysene	5
8.	1,1,2-Trichloro-1,2,2-trifluoroethane	0.5	58.	4-Methylphenol	5	108.	bis-(2-Ethylhexyl)phthalate	5
9.	Acetone	5	59.	N-Nitroso-di-n-propylamine	5	109.	Di-n-octylphthalate	5
10.	Carbon Disulfide	0.5	60.	Hexachloroethane	5	110.	Benzo(b)fluoranthene	5
11.	Methyl Acetate	0.5	61.	Nitrobenzene	5	111.	Benzo(k)fluoranthene	5
12.	Methylene Chloride	0.5	62.	Isophorone	5	112.	Benzo(a)pyrene	5
13.	trans-1,2-Dichloroethene	0.5	63.	2-Nitrophenol	5	113.	Indeno(1,2,3-cd)pyrene	5
14.	Methyl tert-Butyl Ether	0.5	64.	2,4-Dimethylphenol	5	114.	Dibenzo(a,h)anthracene	5
15.	1,1-Dichloromethane	0.5	65.	bis(2-Chloroethoxy)methane	5	115.	Benzo(g,h,i)perylene	5
16.	cis-1,2-Dichloroethene	0.5	66.	2,4-Dichlorophenol	5	<b>PESTICIDES/AROCLORS (PESTICIDES/PCBS)</b>		
17.	2-Butanone	5	67.	Naphthalene	5			
18.	Bromochloromethane	0.5	68.	4-Chloroaniline	5	116.	alpha-BHC	0.01
19.	Chloroform	0.5	69.	Hexachlorobutadiene	5	117.	beta-BHC	0.01
20.	1,1,1-Trichloroethane	0.5	70.	Caprolactam	5	118.	delta-BHC	0.01
21.	Cyclohexane	0.5	71.	4-Chloro-3-methylphenol	5	119.	gamma-BHC (Lindane)	0.01
22.	Carbon Tetrachloride	0.5	72.	2-Methylnaphthalene	5	120.	Heptachlor	0.01
23.	Benzene	0.5	73.	Hexachlorocyclopentadiene	5	121.	Aldrin	0.01
24.	1,2-Dichloroethane	0.5	74.	2,4,6-Trichlorophenol	5	122.	Heptachlor epoxide	0.01
25.	Trichloroethene	0.5	75.	2,4,5-Trichlorophenol	20	123.	Endosulfan I	0.01
26.	Methylcyclohexane	0.5	76.	1,1'-Biphenyl	5	124.	Dieldrin	0.02
27.	1,2-Dichloropropane	0.5	77.	2-Chloronaphthalene	5	125.	4,4'-DDE	0.02
28.	Bromodichloromethane	0.5	78.	2-Nitroaniline	20	126.	Endrin	0.02
29.	cis-1,3-Dichloropropene	0.5	79.	Dimethylphthalate	5	127.	Endosulfan II	0.02
30.	4-Methyl-2-pentanone	5	80.	2,6-Dinitrotoluene	5	128.	4,4'-DDD	0.02
31.	Toluene	0.5	81.	Acenaphthylene	5	129.	Endosulfan sulfate	0.02
32.	trans-1,3-Dichloropropene	0.5	82.	3-Nitroaniline	20	130.	4,4'-DDT	0.02
33.	1,1,2-Trichloroethane	0.5	83.	Acenaphthene	5	131.	Methoxychlor	0.10
34.	Tetrachloromethane	0.5	84.	2,4-Dinitrophenol	20	132.	Endrin ketone	0.02
35.	2-Hexanone	5	85.	4-Nitrophenol	20	133.	Endrin aldehyde	0.02
36.	Dibromochloromethane	0.5	86.	Dibenzofuran	5	134.	alpha-Chlordane	0.01
37.	1,2-Dibromoethane	0.5	87.	2,4-Dinitrotoluene	5	135.	gamma-Chlordane	0.01
38.	Chlorobenzene	0.5	88.	Diethylphthalate	5	136.	Toxaphene	1.0
39.	Ethylbenzene	0.5	89.	Fluorene	5	137.	Aroclor-1016	0.20
40.	Xylenes (total)	0.5	90.	4-Chlorophenyl-phenylether	5	138.	Aroclor-1221	0.40
41.	Styrene	0.5	91.	4-Nitroaniline	20	139.	Aroclor-1232	0.20
42.	Bromoform	0.5	92.	4,6-Dinitro-2-methylphenol	20	140.	Aroclor-1242	0.20
43.	Isopropylbenzene	0.5	93.	N-Nitrosodiphenylamine	5	141.	Aroclor-1248	0.20
44.	1,1,2,2-Tetrachloroethane	0.5	94.	1,2,4,5-Tetrachlorobenzene	5	142.	Aroclor-1254	0.20
45.	1,3-Dichlorobenzene	0.5	95.	4-Bromophenyl-phenylether	5	143.	Aroclor-1260	0.20
46.	1,4-Dichlorobenzene	0.5	96.	Hexachlorobenzene	5			
47.	1,2-Dichlorobenzene	0.5	97.	Atrazine	5			
48.	1,2-Dibromo-3-chloropropane	0.5	98.	Pentachlorophenol	5			
49.	1,2,4-Trichlorobenzene	0.5	99.	Phenanthrene	5			
50.	1,2,3-Trichlorobenzene	0.5	100.	Anthracene	5			

(TCL) based on advances in analytical methods, evaluation of method performance data, and to meet the needs of Superfund program participants. Compounds that have been added to the SOW are shaded in Table 1. The following modifications were made to the low concentration organic analytical service TCL:

- i. New volatile compounds include: dichlorofluoromethane; trichlorofluoromethane;

1,1,2-trichloro-1,2,2-trifluoroethane; methyl acetate; methyl tert-butyl ether; cyclohexane; methylcyclohexane; isopropylbenzene, and 1,2,3-trichlorobenzene.

- ii. New semivolatile compounds include: benzaldehyde; acetophenone; caprolactam; 1,1'-biphenyl; 1,2,4,5-tetrachlorobenzene, and atrazine.

## MODIFICATIONS TO METHODS

Current methods have been modified in an effort to allow CLP participants to use newer techniques or address previous issues. The following items summarize the modifications to the low concentration organic analytical service:

- i. Matrix Spike/Matrix Spike Duplicate (MS/MSD) analysis has been added to this service. This is performed only when requested by a Region for every 20 field samples in an SDG or for each SDG, whichever is most frequent.
- ii. Method Detection Limit (MDL) determination has been added to this service. This is run before any samples are analyzed under contract (annually thereafter) and after major instrument maintenance.

### Volatiles

The following items were changed for volatiles:

- i. All references to System Monitoring Compounds (SMCs) have been removed. Deuterated Monitoring Compounds (DMCs) will be used

instead and are added to each sample, standard, and blank.

- ii. All references to Laboratory Control Samples (LCSs) have been removed.

### Semivolatiles

The following items were added or changed for semivolatiles:

- i. All references to surrogates have been removed. DMCs are now required to be added to each sample, standard, and blank.
- ii. All references to LCSs have been removed.

For more information, or for suggestions to improve this analytical service, please contact:

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**APPENDIX F**

**SAMPLERS GUIDE TO  
CONTRACT LAB PROGRAM**

United States  
Environmental Protection  
Agency

Office of  
Solid Waste and  
Emergency Response

9240.0-30  
EPA/540/R-96/032  
PB96-963511

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Superfund

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## **SAMPLER'S GUIDE TO THE CONTRACT LABORATORY PROGRAM**



9240.0-30  
EPA/540/R-96/032  
PB96-963511

## **Sampler's Guide to the Contract Laboratory Program**

Office of Emergency and Remedial Response  
U.S. Environmental Protection Agency  
Washington, DC 20460

## NOTICE

The policies and procedures set forth here are intended as guidance to Agency and other government employees. They do not constitute rulemaking by the Agency, and may not be relied on to create a substantive or procedural right enforceable by any other person. The Government may take action that is at variance with the policies and procedures in this manual.

For further information on the Contract Laboratory Program (CLP) or to obtain a copy of the *User's Guide to the Contract Laboratory Program*, contact the National Technical Information Service (NTIS) of the United States Department of Commerce at (703) 487-4650. In addition, the entire current Superfund bibliography may be purchased from NTIS at (703) 487-4650.

Additional copies of this manual can be obtained from:

National Technical Information Service  
U.S. Department of Commerce  
5285 Port Royal Road  
Springfield, VA 22161  
(703) 487-4650

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## PREFACE

The *Sampler's Guide to the Contract Laboratory Program* has been prepared by the U.S. Environmental Protection Agency Analytical Operations Center. It is specifically designed for samplers to help clarify sampling procedures necessary to submit samples for CLP analysis. The *Sampler's Guide to the Contract Laboratory Program* acts as a reference for the Regions and sampling contractors to promote consistency in sampling procedures throughout the Regions and to ensure the proper adherence to CLP requirements. This document is intended to be used as a supplement to, not as a replacement for, existing Regional sampling instructions.

## ACKNOWLEDGMENTS

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Patricia Gowland,  
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Lucinda Taylor.

## 1.0 THE CLP NETWORK

The Contract Laboratory Program (CLP) is a national program of commercial contractor laboratories supporting the Environmental Protection Agency's (EPA's) Superfund nationwide effort to clean up designated hazardous waste sites. Superfund was originally established under the 1980 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and presently exists under the 1986 Superfund Amendments and Reauthorization Act (SARA).

The CLP provides chemical analytical services using state-of-the-art technology for the ten EPA Regions. The program is structured to provide data of known and documented quality for use in supporting EPA enforcement actions or other user needs. To achieve this goal, the CLP has established strict quality assurance procedures and detailed documentation requirements.

The CLP is directed by the Analytical Operations Center (AOC) in the Office of Emergency and Remedial Response (OERR) in the Office of Solid Waste and Emergency Response (OSWER). AOC includes the Organic and Inorganic Program Coordinators and the Administrative Project Officers (APOs) for the CLP laboratories, the Project Officer for the Contract Laboratory Analytical Services Support (CLASS) contract, the Project Officer for the Quality Assurance Technical Support (QATS) contract, the National Automated Data Processing (ADP) Manager, and the Quality Assurance Coordinator. AOC responsibilities include the following:

- Development of analytical methods;
- Development of the Statements of Work (these documents define required analytical methods, quality control, detection/quantitation limits and holding times) for the analytical services procured under the CLP;
- Development of and implementing policies and budgets for Superfund analytical operations;
- Development of information management policies and products for analytical data;
- Management of the CLASS and QATS contracts;
- National administration, evaluation, and management of the CLP; and
- Direction of CLP quality assurance activities in coordination with overall OSWER quality assurance activities.

In coordinating Superfund sampling efforts, AOC is supported by the APOs, the contractor-operated CLASS office, the Regional Technical Project Officers (TPOs), the Regional Sample Control Centers (RSCC's), and the Regional Site Managers (Site Assessment Managers, On-Scene Coordinators and Remedial Project Managers). See Exhibit 1-1 for a generalized organization chart (functions may vary by Regions).

Currently, AOC is allowing other Agencies/Departments the opportunity to "buy-into" the CLP. This is being done on a cost-reimbursable basis through Interagency Agreements.

### **Administrative Project Officer**

The APO is responsible for monitoring laboratory performance, initiating contract action, and funding laboratory contracts. The APO works closely with the TPOs and laboratories to resolve problems. The APO is also responsible for developing analytical methods and designing new CLP services.

### Contract Laboratory Analytical Services Support

The CLASS contractor provides management, operations, and administrative support to the CLP. The CLASS contractor routinely receives Regional analytical requests, coordinates and schedules sample analyses, tracks sample shipments and analyses, receives and checks data for completeness and compliance, processes laboratory invoices, and maintains a repository of sampling records and program data.

### Regional Technical Project Officer

The TPO monitors the technical performance of the contract laboratories in his or her Region. The TPO works closely with the APOs in responding to laboratory technical problems and leads laboratory on-site evaluations. The TPO is the sole Regional official who may contact the CLP laboratories.

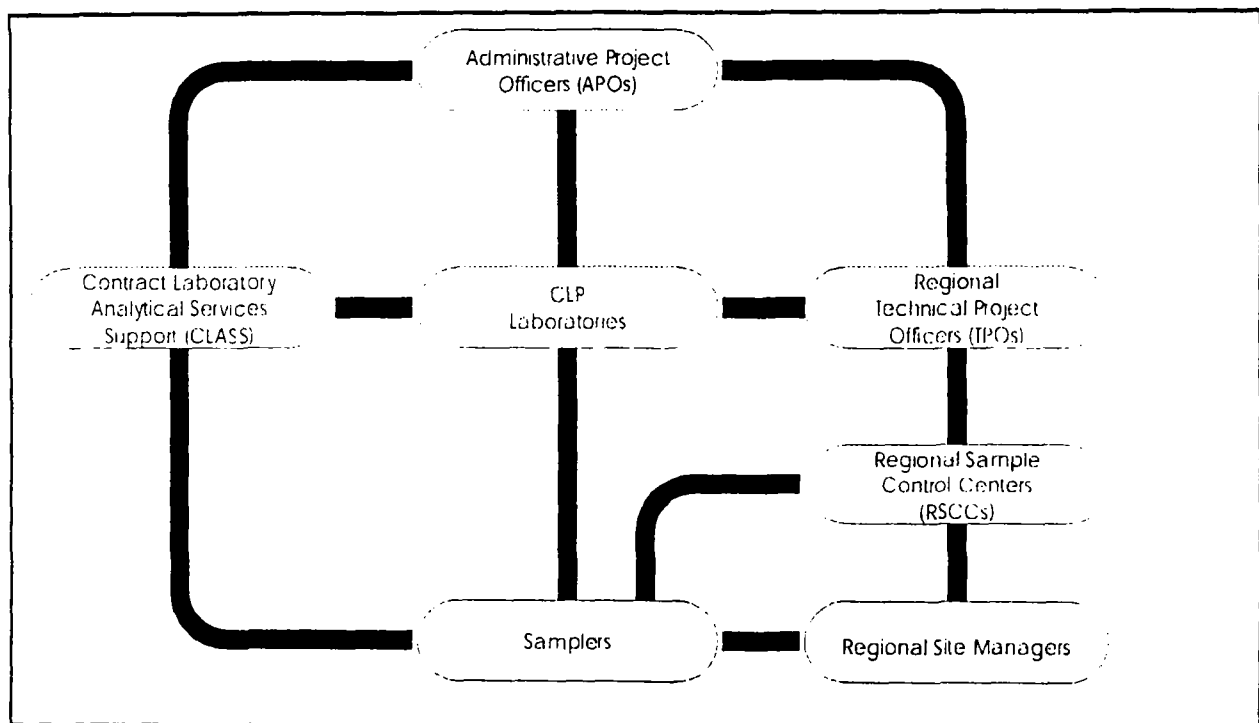
### Regional Sample Control Center

In most Regions, the RSCC coordinates the sampling efforts and serves as the central point of contact for sampling questions and problems. The RSCC assists in coordinating the level of Regional sampling activities to correspond with the monthly projected demand for analytical services.

### Regional Site Manager

The Regional Site Manager (Site Assessment Manager, On-Scene Coordinator or Remedial Project Manager) is responsible for coordinating the development of data quality objectives and for overseeing project-specific remedial contractors, state officials, or private parties conducting site sampling efforts.

Exhibit 1-1. CLP Organization Chart





## 1.1. PROCUREMENT OF CONTRACT LABORATORY SERVICES

### 1.1.1. Procedures for requesting/scheduling analytical services.

To initiate a CLP Analytical Services (CLPAS) request, the RSCC or Regional/Agency designee contacts the appropriate CLASS Coordinator by telephone or fax and provides a complete description of the analytical requirement. The information required to initiate a CLPAS request includes the sampler's name, sampler's phone number, site name, city and state where the site is located, site spill identification number, expected date of sample shipment, number of samples, type of analyses, turn-around-time, fractions to be analyzed, and sample matrix.

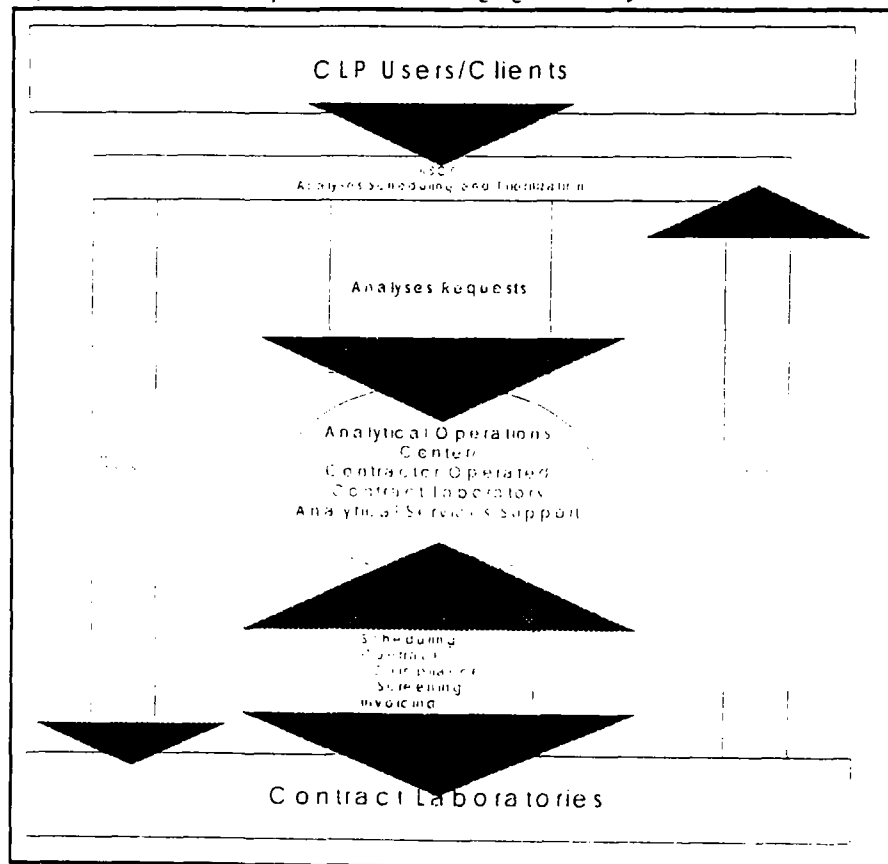
#### 1.1.1. Timing and scheduling

By noon eastern time on the Wednesday of the week prior to the scheduled start of a planned sampling activity, the RSCC or Regional/Agency designee contacts the CLASS Coordinator to place a CLPAS request and to provide scheduling information to the CLASS contractor. This lead-time enables the laboratories to prepare for EPA samples, and to provide for resolution of sampling questions. It also allows the sampler time to prepare the required sample documentation prior to field activity, if appropriate. Late scheduling requests (i.e., requests received between Wednesday noon and the date of sampling) are accommodated with available laboratory capacity. To avoid possible shortfalls, Regions are strongly encouraged to submit all CLPAS scheduling requests prior to Wednesday noon, when possible. A more complete discussion of the procedures for arranging CLP analytical services can be found in the

User's Guide  
to the  
Contract  
Laboratory  
Program.

#### 1.1.2. Chain of Communication within the CLP

Exhibit 1-2.



## 2.0 CONTRACT LABORATORY ANALYTICAL SERVICES SUPPORT

The CLP provides the user community with a wide range of Contract Laboratory Program Analytical Services (CLPAS) through laboratories that have been awarded government contracts under the CLP.

CLPAS services generally apply to the analysis of water and soil/sediment samples for specific target organic and inorganic analytes, and are performed under firm, fixed-price, standardized contracts that include standard analytical methodologies, quality assurance and quality control (QA/QC) procedures, and data reporting formats. The CLP analytical services are shown with their corresponding fractions and concentrations in Exhibit 2-1.

EPA Regions may request a portion of the analytical services provided under the CLP. For example, CLP Analytical Services-volatile analysis may be ordered without CLP Analytical Services-semi-volatile analysis or CLP Analytical Services-pesticide/Aroclor analysis. However, CLP Analytical Services-pesticide analysis may not be ordered without CLP Analytical Services-Aroclor analysis, since fractions may not be split.

Exhibit 2-1. Contract Laboratory Program Analytical Services

STATUS OF SERVICE	ANALYTICAL SERVICES	FRACTIONS	CONCENTRATION <sup>1</sup>	MATRIX	TURN-AROUND TIMES <sup>2</sup>
Available	Multi-Media, Multi-Concentration Organics (Low-Medium)	Volatiles, Semivolatiles, Pesticides/Aroclors	Low, Medium	Water, Soil, Sediment	14 or 35 days, depending on contract requirements
	Multi-Media, Multi-Concentration Inorganics (Low-Medium)	Total Metals, Dissolved Metals, Cyanide	Low, Medium	Water, Soil, Sediment	14 or 35 days, depending on contract requirements
Future	Low Concentration Organics	Volatiles, Semivolatiles, Pesticides/Aroclors	Low	Water	14 days
	Water Quality, Wet Chemistry	Alkalinity, Ammonia, Total Organic Carbon, Chemical Oxygen Demand, Chloride, Nitrate-Nitrite, Phosphorus, Total Dissolved Solids, Total Suspended Solids, Sulfate	Low, Medium, High	Water	14 days

See Section 3.1, CLPAS Sample Definition, for the definitions of low, medium, and high concentrations. Turnaround times are the maximum time allowed under the CLPAS contracts for laboratory submission of all reporting and deliverable requirements. Turnaround times for each sample are calculated from the day on which the sample is received at the CLP laboratory, as recorded on the shipper's delivery receipt and traffic report/chain-of-custody form. Low concentration for these services refers to the analytical quantitation limits for drinking water samples.

### 3.0 SAMPLE COLLECTION

#### 3.1 Sample Definition

A CLP Analytical Services sample is defined by one sample matrix at one concentration level from one station location for each individual or set of analytical fraction(s), provided the fractions are all requested from the same CLP Analytical Service. CLP Analytical Services are generally used to analyze low and medium concentration samples. Low concentration samples are considered to be those samples collected in areas where immediate hazards are thought to be significantly reduced either by normal environmental processes or because of limited contamination. Medium concentration samples are most often those collected on-site in areas of moderate dilution by normal environmental processes. High concentration samples are considered to be those collected directly from drums, pits, ponds, lagoons, or areas where no dilution of waste is evident [these sample analyses are not available under current CLP Statements of Work]. For the most current definition of low or medium concentration please refer to the current CLP Statements of Work. The sampler must identify low, medium, and high concentration samples in the field in order to determine sample collection volume, packaging, and shipping procedures. CLP Analytical Services matrices can be water, soil or sediment. In some instances a mixed-matrix sample may be collected which contains either a supernatant (for a sediment/soil sample) or a precipitate (for a water sample). In those instances, it is best to discuss the required procedures with the TPO or APO. In general, two individual samples should be collected by separating the aqueous layer from the solid/precipitate layer at the point of collection is preferable.

A CLP Analytical Services sample consists of all sample aliquots (portions) from one station location, for one matrix, for one analytical program, for one laboratory necessary to collect appropriate volumes needed for the analysis of each fraction. One CLP Analytical Services sample may be contained in several bottles and vials. For example for the Low/Medium Organics CLP Analytical Service, one water sample might consist of all of the containers needed for the three analytical fractions available under this service (i.e., volatile fraction, semi-volatile fraction, and pesticide/Aroclor fraction), even though the fractions will be collected in separate containers. Therefore, the fractions of the CLP Analytical Service, along with the type of matrix and the expected concentration level (low/medium or high level), determine container type and volume.

As an example, let's say you are sampling at Leroy's Pond (see Exhibits 3.1 and 3.2). *You are instructed to collect one low/medium concentration water sample and one low/medium concentration soil/sediment sample, each to be analyzed for all of the low/medium organic and inorganic fractions available through CLP Analytical Service.* According to CLP guidelines, each individual inorganic sample may be analyzed for total metals or dissolved metals, but not both. If you want data for both dissolved metals and total metals from the same station location, you must collect two separate samples and assign them each unique CLP sample numbers.

For the CLP Analytical Services Multi-Media, Multi-Concentration Inorganics (Low/Medium) contract, the analytical fractions of interest are total metals and cyanide. For the CLP Analytical Services Multi-Media, Multi-Concentration Organics (Low/Medium) contract, the analytical fractions of interest are volatiles, semivolatiles, and pesticides/Aroclors. In the future it will be possible to consider the Organic Low Concentration (water only) service.

Exhibit 3-1. Sampling at Leroy's Pond

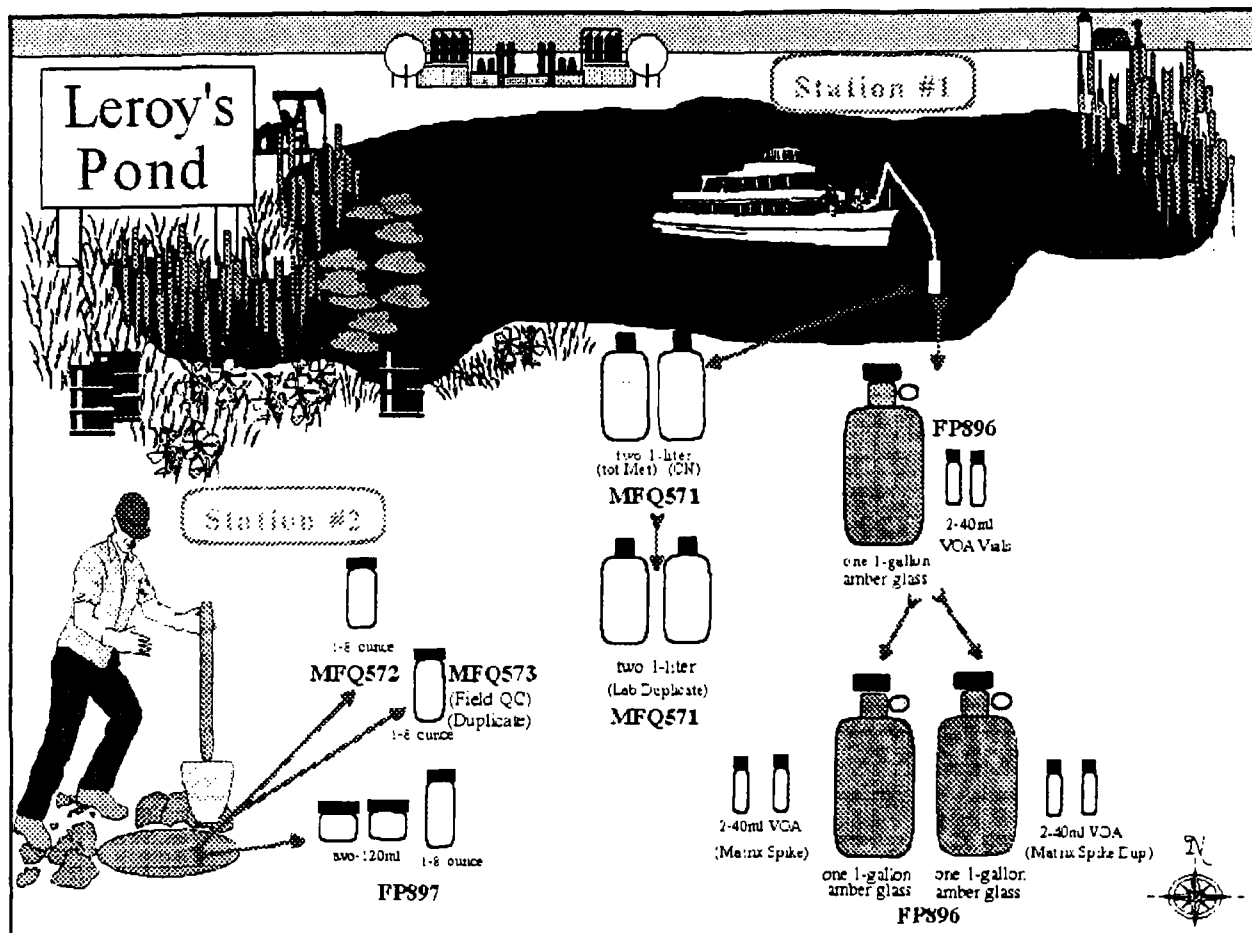


Exhibit 3-2. Table of Sampling at Leroy's Pond

MATRIX	LOW/MEDIUM ORGANICS	LOW/MEDIUM INORGANICS
Water	Volatiles Semivolatiles Pesticides/Aroclors	Total Metals Cyanide
Soil Sediment	Volatiles Semivolatiles Pesticides/Aroclors	Total Metals Cyanide
Total number of samples collected = 4	2 organic samples (1 water + 1 soil/sediment)	2 inorganic samples (1 water + 1 soil-sediment)

Because you are collecting samples from two matrices for two analytical services, you must collect four separate samples: one water sample and one soil/sediment sample to be analyzed for CLP Analytical Services organics and one water sample and one soil/sediment sample to be analyzed for CLP Analytical Services inorganics. Note that a single sample may consist of several containers because each fraction and each concentration category require a certain volume for analysis.

### 3.2 CLP Analytical Services and Project Data Quality Objectives

Before requesting CLP Analytical Services, project managers should evaluate whether the services offered under the CLP are appropriate to meet the Data Quality Objectives (DQOs)<sup>1</sup> established for their project. This evaluation should take place during the planning stages of a sampling project and be documented in the Quality Assurance Project Plan (QAPP)<sup>2</sup> and/or the Sampling and Analysis Plan (SAP)<sup>3</sup>.

The following specifications/features of CLP Analytical Services (this information is generally found in the Statement of Work for the analytical service) should be evaluated to determine the adequacy of the standardized services to meet the project DQOs:

- list of included target analytes/compounds
- sample concentrations covered
- required minimum sample volumes
- laboratory subsample size
- sample preparation and digestion methods
- analytical methods
- turnaround times
- Instrument Detection Limits
- Contract Required Quantitation/Detection Limits
- QA/QC requirements (e.g., identity, frequency, and acceptance criteria for laboratory QC samples)
- laboratory sample receipt and custody requirements
- data package deliverables (reporting requirements)

For example, the detection limits required to meet the project DQOs for some risk assessments might be lower than the Contract Required Detection Limits offered by the CLP. The standard CLP digestion and analytical methods might not be suitable for the sample matrix of interest. The CLP data turnaround times might be too long for some emergency response sampling projects. For situations such as the emergency response scenario, it is possible that a combination of CLP Analytical Services for the non time-critical analytes and alternative fast-turnaround services (1+ day turnaround time) for the time-critical analytes would be adequate to meet the project DQOs.

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<sup>1</sup>For more information regarding QA and SAP planning and the DQO process, consult the documents listed in Section 9.0 of this guide.

If it is determined that CLP Analytical Services will not be adequate for all or some of the samples to be collected, alternatives should be explored. Each EPA Region may have developed analytical services options to supplement the laboratory services available nationally through the CLP. Contact the appropriate Regional analytical services representatives (usually the personnel listed in Section 7.0, Communications Network) for guidance in obtaining analytical services that will meet project DQOs.

### 3.3 References to CLP Laboratory Services in QAPPs and SAPs

QAPPs and SAPs typically contain sections describing analytical laboratory services. Standard, or boiler-plate, language is often used to describe laboratory requirements for procedures such as sample receipt and notification and laboratory participation in analyzing Performance Evaluation Samples (PESs). CLP contract specifications are designed to incorporate many of the most common good laboratory practice requirements, such as the requirement for laboratory Quality Management Plans (QMPs for further information see Section 9.0). If CLP Analytical Services will be requested for all or some of the samples covered in a QAPP and/or SAP, care should be taken to ensure that the QAPP/SAP descriptions of laboratory services for the CLP-destined samples are compatible with the CLP contract specifications. For example, CLP contracts do not allow CLP laboratories to contact samplers directly regarding problems with sample receipt. (Note that only the EPA Contracting Officer for the CLP has the authority to modify CLP contract specifications.) **It is generally the responsibility of the project manager to make sure that the project laboratory services requirements are communicated to the Regional analytical services representatives.**

QAPPs and/or SAPs also typically include standard operating procedures (SOPs) for procedures such as completing chain-of-custody forms, sample identification, and sample packaging and shipment. SOPs that will be used when collecting samples for analysis through the CLP should be reviewed before use to ensure that CLP requirements are accommodated. Many consultants' SOPs call for the site name to be provided on the form. However, for CLP Analytical Services samples, Case Numbers, rather than site names are used. SOPs associated with the collection of CLP samples should be reviewed before use to ensure that CLP requirements are accommodated.

In addition, QAPPs and SAPs specify such information as the analytical methods and laboratory QC requirements that will be used for samples. When CLP Analytical Services will be requested for samples, it is common for the QAPP or SAP to reference the appropriate CLP Statement of Work (SOW) for details such as the laboratory QC sample frequencies. There is often confusion regarding how to reference CLP SOWs, because several versions of a SOW for a particular analytical service, such as "Low/Medium Organics," may be active under contracts at the same time. Also QAPP and SAP authors do not control CLP laboratory assignments and will not know in advance which laboratory and corresponding SOW version will be assigned for their samples. Therefore, QAPP and SAP authors should refer to CLP SOWs as in the following example:

"Low/medium concentration soil samples will be analyzed according to the specifications of the current EPA Superfund Contract Laboratory Program Statement of Work for Multi-Media, Multi-Concentrations Organics."

### 3.4 Sample Volume

The collection of proper sample volume is imperative to the success of sample analysis. If sufficient sample volume is not collected, the analysis of all required parameters and complete quality control determinations may not be possible. (See Section 3.6, Quality Control Samples.) Therefore, it is especially important to note the volume requirements for each specified. If adequate sample volume cannot be collected, notify the authorized RSCC or CLP Analytical Services Support personnel sample immediately. Note that more than one container may be required to provide the total volume of sample needed (e.g., two 40-ml glass vials for one volatile organic compound [VOC] analysis). Exhibits 3-3 and 3-4 specify the required sample volume and container type for each CLP Analytical Services fraction. Container type codes are detailed in Section 3.5, Sample Containers, and in Exhibit 3-5.

**Exhibit 3-3. Low/Medium Organics Sample Volume**

SAMPLE MATRIX	CONCENTRATION	FRACTION	LABORATORY QC SAMPLE VOLUME	MINIMUM SAMPLE VOLUME	CONTAINER TYPE <sup>1</sup>
Water	Low/Medium	Volatiles	4 each (40 mL)	2 each (40 mL)	B or D
		Semivolatiles	4 L	2 L	A,E,F,G,H,I, or K
		Pesticides/Aroclors	4 L	2 L	A,E,F,G,H,I, or K
Soil, Sediment	Low/Medium <sup>2</sup>	Volatiles	4 each (40 mL)	2 each (40 mL)	D or B
		Semivolatiles	4 oz.	4 oz.	A,E,F,G,H,I, or K
		Pesticides/Aroclors	4 oz.	4 oz.	A,E,F,G,H,I, or K

<sup>1</sup> Some sample containers may have small neck sizes and inhibit sampling efforts. See Exhibit 3.4 for container types.

<sup>2</sup> All medium soil/sediment sample containers should be double contained before shipment (e.g., sample bottle/jar/vial placed in clean, lidded metal paint can). Consult DOT regulations for applicable shipping requirements.

**Exhibit 3-4. Low/Medium Inorganics Sample Volume**

SAMPLE MATRIX	CONCENTRATION	FRACTION	LABORATORY QC SAMPLE VOLUME	MINIMUM SAMPLE VOLUME	CONTAINER TYPE <sup>1</sup>
Water	Low/Medium	Total Metals	1L	1 L	A,C,E,F,G,H,I,K, or L
		Dissolved Metals	1L	1 L	A,C,E,F,G,H,I,K, or L
		Cyanide	1.5 L	1 L	A,C,E,F,G,H,I,K, or L
Soil, Sediment	Low/Medium <sup>2</sup>	Total Metals	6 oz.	6 oz.	A,C,E,F,G,H,I,K, or L
		Cyanide	6 oz.	6 oz.	A,C,E,F,G,H,I,K, or L

<sup>1</sup> Some sample containers may have small neck sizes and inhibit sampling efforts. See Exhibit 3.4 for container types.

<sup>2</sup> All medium concentration soil/sediment sample containers should be double contained before shipping (e.g., sample bottle/jar/vial placed in clean, lidded metal paint can). Consult DOT regulations for applicable shipping requirements.

### 3.5 Sample Containers

Exhibit 3-4 lists sample containers generally used during sample collection. Always use clean sample containers of an assured quality. For container cleaning procedures and additional container information, refer to the current iteration of *Specifications and Guidance for Contaminant-Free Sample Containers*.

December 1992, OSWER Directive 92.0-05A. See Exhibits 3-3 and 3-4 for sample volume requirements. Samplers may wish to purchase pre-cleaned/quality assured bottles in lieu of cleaning their own bottles.

### 3.6 Quality Control Samples

QC samples are used to estimate the precision and accuracy of analytical results and to examine sources of error introduced by field and laboratory practices. A designated number of field QC samples may be included in each batch of samples which are sent to the CLP laboratory, as specified by the Sampling and Analysis Plan. A designated number of laboratory QC samples must be included in each batch of samples which are sent to the laboratory, as specified by

### Exhibit 3-5 Sample Container Types

CONTAINER TYPE	SPECIFICATIONS
A	<b>Container:</b> 80-oz. amber glass, ring handle bottle/jug, 38-mm neck finish. <b>Closure:</b> Polypropylene or phenolic cap, 38-430 size; 0.015-in Teflon liner.
B	<b>Container:</b> 40-mL glass vial, 24-mm neck finish. <b>Closure:</b> Polypropylene or phenolic, open-top, screw cap, 15-cm opening, 24-400 size. <b>Septum:</b> 24-mm disc of 0.005-in Teflon bonded to 0.120-in silicon for total thickness of 0.125-in.
C	<b>Container:</b> 1-L high density polyethylene, cylinder-round bottle, 28-mm neck finish. <b>Closure:</b> Polyethylene cap, ribbed, 28-410 size; F217 polyethylene liner.
D	<b>Container:</b> 120-mL wide mouth glass vial, 48-mm neck finish. <b>Closure:</b> Polypropylene cap, 48-400 size; 0.015-in Teflon liner.
E	<b>Container:</b> 16-oz. tall, wide mouth, straight-sided, flint glass jar, 63-mm neck finish. <b>Closure:</b> Polypropylene or phenolic cap, 63-400 size; 0.015-in Teflon liner.
F	<b>Container:</b> 8-oz. short, wide mouth, straight-sided, flint glass jar, 70-mm neck finish. <b>Closure:</b> Polypropylene or phenolic cap, 70-400 size; 0.015-in Teflon liner.
G	<b>Container:</b> 4-oz. tall, wide mouth, straight-sided, flint glass jar, 48-mm neck finish. <b>Closure:</b> Polypropylene or phenolic cap, 48-400 size; 0.015-in Teflon liner.
H	<b>Container:</b> 1-L amber, Boston round, glass bottle, 33-mm pour-out neck finish. <b>Closure:</b> Polypropylene or phenolic cap, 33-430 size; 0.015-in Teflon liner.
J	<b>Container:</b> 32-oz. tall, wide mouth, straight-sided, flint glass, 89-mm neck finish. <b>Closure:</b> Polypropylene or phenolic cap, 89-400 size; 0.015-in Teflon liner.
K	<b>Container:</b> 4-L amber glass, ring handle bottle/jug, 38-mm neck finish. <b>Closure:</b> Polypropylene or phenolic cap, 38-430 size; 0.015-in Teflon liner.
L	<b>Container:</b> 500-mL high-density polyethylene, cylinder-round bottle, 28-mm neck finish. <b>Closure:</b> Polypropylene cap, ribbed, 28-410 size; F217 polyethylene liner.
M	<b>Container:</b> 120-mL wide mouth glass vial, 48-mm neck finish. <b>Closure:</b> Polypropylene cap, 48-400 size; 0.015-in Teflon liner.

the CLP contract. Because the amount and type of QC samples collected vary between Regions, always refer to Regional guidance. Note that the types and frequencies of field QC samples should always meet project DQOs.

Field QC samples may include field duplicate samples, trip blanks, equipment blanks, and field blanks. The field QC samples should be prepared (i.e., labeled, packaged, preserved, and shipped to the assigned laboratory) identically to the primary field samples, and should remain "blind" to the laboratory to ensure indiscriminate handling. Each field QC sample receives a separate sample number. See Section 5.0, Sample Documentation.

Laboratory QC samples include matrix spikes and matrix spike duplicates for organic samples and matrix spike and sample duplicates for inorganic samples. The laboratory QC sample is an additional volume of an existing sample required by the laboratory's contract; the additional volume must be supplied by the sampler (see exhibits 3-3 and 3-4). Samplers should designate one sample per matrix per 20 samples as a "laboratory QC" sample. If the sampler does not designate a sample as the "laboratory QC," then it is possible that the laboratory could select the blank as the QC or use the primary field samples to meet contract QC requirements. The laboratory use of primary field samples for QC analysis can detract from data quality and useability. For example, if a laboratory requires two liters of field sample to perform a requested analysis without QC, and the laboratory receives two liters of field sample to perform the requested analysis along with matrix spike and duplicate analyses, the laboratory may split the field sample using



one liter for the required analysis and one half liter each for the matrix spike and duplicate analyses. In doing so, the laboratory will double the achievable sample quantitation limits, and possibly fail to meet project DQOs. Samplers should label the laboratory QC sample containers and corresponding paperwork as "lab QC" as described in Section 5.4, Traffic Report/Chain-of-Custody Forms. Remember that the laboratory QC sample is not an additional sample and does not receive its own unique sample number. Exhibit 3-6 explains some of the types of QC samples that may be collected. Follow volume requirements as specified in Section 3.4, Sample Volume.

### 3.7 Duplicate and Split Samples

Duplicate samples may be collected to determine the variability of the sampling process. Duplicate samples should be collected simultaneously from the same source and under identical conditions as the original sample. Aqueous duplicate samples are collected from successive volumes from the same sample source and device (e.g., bailers). Soil duplicates are collected from the same sample source and device.

Split samples may be collected to measure the variability between laboratories. The sample should be collected by separating one sample into two or more sample containers. Aqueous split samples should be collected by either obtaining consecutive sample volumes from the same bailer or mixing the volumes in a large intermediate vessel, as appropriate, depending on the nature of contaminants and Regional guidance. When collecting aqueous samples with devices, such as a bailer, for example, the following guidance should be followed. If more than one bailer is required to obtain the required sample volume, the first half volume of the first bailer should be poured into the first container, and the second half volume of the first bailer should be poured into the second container.

The first half volume of the second bailer should be poured into the second container, and the second half volume of the second bailer should be poured into the first container. This filling sequence should continue until both containers are filled. Please note that when sampling for VOC analysis, more than one bailer should not be used and sample mixing should be avoided because these procedures may increase analyte loss due to evaporation. Refer to Section 4.2.1, Volatile Organic Compound Collection, for guidelines on collecting samples for VOC analysis. When split samples are collected using an intermediate vessel, continually stir the contents of the intermediate vessel with a clean pipette or precleaned Teflon rod, and allow the contents to be alternately siphoned into respective sample containers using Teflon tubing. Any device used for stirring, or tubing used for siphoning, must be cleaned in the same manner as other equipment. Since a true split for sediment, sludge, and soil samples is not feasible under field conditions, a split soil sample should be considered a duplicate.

### 3.8 Performance Evaluation Samples

A Performance Evaluation Sample (PES) is a specially prepared Quality Control sample which is used to evaluate a laboratory's analytical proficiency. Most of the Organic PESs are supplied in ampules while most of the Inorganic PESs are supplied in plastic bottles. The frequency of use and the type(s) of PES(s) to be used during a sampling event should be specifically addressed in the Sampling and Analysis Plan. The availability and use of PESs should be coordinated through the Regional RSCC and/or TPO contact.

### 3.9 Recommendations for CLP Analytical Services Sample Preservation and Holding Times

#### Sample Preservation

Some water samples must be chemically preserved before shipment to the laboratory. All low concentration samples should be cooled to  $4^{\circ} \pm 2^{\circ}\text{C}$ . Samples should be preserved and cooled immediately upon sample collection. Preservation techniques vary among the Regions; so use the information in Exhibit 3-7 as general guidance for properly preserving samples. Contact your RSCC for Region-specific instructions.

Exhibit 3-6 QC Samples

QC SAMPLE	SAMPLE TYPE	PURPOSE	COLLECTION <sup>1</sup>	SAMPLE NUMBER
Field QC Samples	Field Duplicate <sup>2</sup>	To check reproducibility of laboratory and field procedures. To indicate matrix non-homogeneity.	Collect from areas that are known or suspected to be contaminated. Collect one sample per week or 10% (Regions may vary) of all field samples per matrix, whichever is greater.	Assign two separate (unique) CLP sample numbers (i.e., one number to the primary sample and one to the duplicate). Submit blind to the lab.
	Field Blank	To check cross-contamination during sample collection, sample shipment, and in the laboratory. Also to check sample containers.	Collect for each group of samples of similar matrix per each day of sampling. Use water (demonstrated to be free of the contaminants of concern) for organics; use metal-free (deionized or distilled) water for inorganics.	Assign separate CLP sample numbers to the field blanks. Submit blind to the lab.
	Volatiles Trip Blank	To check contamination during sample handling and shipment from field to laboratory.	Collect one sample (water demonstrated to be free of the contaminants of concern) per each day of organics sampling. This sample is prepared off-site, before sampling commences, and placed in the cooler used to ship volatile samples.	Assign separate CLP sample numbers to the trip blanks. Submit blind to the lab.
	Equipment Blank or Rinse Blank	To check field decontamination procedures.	Collect when sampling equipment is decontaminated and reused in the field or when a sample collection vessel (bailer or beaker) will be used. Use blank water (water demonstrated to be organic-free, deionized or distilled for inorganics) to rinse the equipment, and collect this rinse water into the sample containers.	Assign separate CLP sample numbers to the equipment blanks. Submit blind to the lab.
Laboratory QC Samples <sup>3</sup>	Matrix Spike and Matrix Spike Duplicate	Required by laboratory's contract to check accuracy and precision of organic analyses.	Collect triple volume for one water sample per 20 water samples. The triple volume water sample should be collected in the first shipment of organics samples.	Assign the primary sample, extra volume, matrix spike and matrix spike duplicate the same CLP sample number. Label the extra volume "Lab QC."
	Matrix Spike and Lab Duplicate	Required by laboratory's contract to check accuracy and precision of inorganic analyses.	Collect double volume for one water sample per 20 water samples. The double water volume sample should be collected in the first shipment of inorganic samples.	Assign the primary sample, extra volume, spike and duplicate the same CLP sample number. Label the extra volume "Lab QC."

<sup>1</sup> Consult Regional guidance for field QC sample frequencies; laboratory QC sample frequencies are fixed in the CLP contracts.

<sup>2</sup> A true split for sediment, sludge, and soil samples (and other heterogeneous samples such as highly turbid waters) is typically not feasible under field conditions. A split of this type of sample should generally be considered a duplicate.

<sup>3</sup> No extra volume is required for the soil/sediment matrix; however, the sample to be used for laboratory QC must be designated on the TR COC.

## **Holding Times**

Samples should be shipped to scheduled CLP laboratories as soon as possible after collection. Daily shipment of samples to CLP laboratories is very important, whenever possible, because many samples are stable only for a short period of time following collection. The technical holding times listed in Exhibit 3-7 are the maximum lengths of time that samples may be held from the time of collection to the time of analysis and still be considered valid.

Samples that exceed these holding times may not be valid, and re-sampling may be necessary. The contractual holding times in Exhibit 3-8 are holding times that the CLP laboratory must follow to comply with the terms of the contract and are described in the CLP Analytical Services SOW. Contractual holding times are the same or shorter than the technical holding times to allow for sample packaging and shipping.

### Exhibit 3-7 Recommendations for Sample Preservation and Technical Holding Times

PARAMETER TYPE	MEASUREMENT	PRESERVATIVE	TECHNICAL HOLDING TIME	CONTRACT MANDATED HOLDING TIME
Metals	Dissolved	Filter on-site, HNO <sub>3</sub> to pH<2, Cool, 4°C	6 Months <sup>1</sup>	180 Days*
	Suspended	Filter on-site, Cool, 4°C	6 Months	180 Days*
	Total	HNO <sub>3</sub> to pH<2, Cool 4°C	6 Months	180 Days*
	Chromium <sup>6+</sup>	Cool, 4°C	24 Hours	180 Days <sup>4</sup>
	Mercury Dissolved	Filter, HNO <sub>3</sub> to pH<2, Cool, 4°C	28 Days	26 Days <sup>4</sup>
	Mercury Total	HNO <sub>3</sub> to pH<2, Cool, 4°C	28 Days	26 Days <sup>4</sup>
Inorganics, Non-Metals	Alkalinity	Cool, 4°C	14 Days	14 Days
	Carbon, Total Organic	Cool, 4°C, H <sub>2</sub> SO <sub>4</sub> to pH<2	28 Days	28 Days
	Chemical Oxygen Demand	Cool, 4°C, H <sub>2</sub> SO <sub>4</sub> to pH<2	28 Days	28 Days
	Chloride	None Required	28 Days	28 Days
	Cyanide	Cool, 4°C, NaOH to pH>12, 0.6 g ascorbic acid	14 Days <sup>1</sup>	12 Days
	Nitrogen Ammonia	Cool, 4°C, H <sub>2</sub> SO <sub>4</sub> to pH<2	28 Days	28 Days
	Nitrate plus Nitrite	Cool, 4°C, H <sub>2</sub> SO <sub>4</sub> to pH<2	28 Days	28 Days
	Phosphorus	Cool, 4°C, H <sub>2</sub> SO <sub>4</sub> to pH<2	28 Days	28 Days
	Solids, Total Dissolved	Cool, 4°C	7 Days	7 Days
	Solids, Total Suspended	Cool, 4°C	7 Days	7 Days
	Sulfate	Cool, 4°C	28 Days	28 Days
	Anions by Ion Chromatography	Cool, 4°C	28 Days	28 Days
Organics	Pesticides, Aroclors	Cool, 4°C, pH 5-9	14 Days	Extract in 10 Days
	Semivolatiles	Cool, 4°C, store in dark	Extract in 7 days	Extract in 10 Days
	Volatiles (preserved)	Cool, 4°C, HCl to pH<2	14 Days	10 Days <sup>2</sup>

\*Source: Adapted from EPA-600/4-82-0155, Technical Additions to Methods for Chemical Analysis of Water and Wastes and 40 Code of Federal Regulations § 136 Table II --Required Containers, Preservation Techniques, and Holding Times, 1995

These are recommendations for sample preservation and holding times for aqueous samples. No official technical holding times are specified for soils/sediments under Superfund. However, EPA-specified contractual holding times do apply to soils/sediments. See Section 4.2.1, Volatile Organic Compound Collection for recommended procedures for the collection, handling, and preservation of soil samples to minimize the loss of volatile compounds. Please check your CLP Analytical Services SOW for required preservatives and holding times.

Samples should be filtered immediately on-site before adding a preservative.

Only use ascorbic acid in the presence of residual chloride. See section 4.2.1.

Maximum holding time is 24 hours when sulfide is present. Optionally, all samples may be tested with lead acetate paper before the pH adjustment to determine if sulfide is present. If sulfide is present, it can be removed by adding cadmium nitrate powder until a negative spot test is obtained using lead acetate paper. The sample is filtered and then NaOH is added to pH>12.

Analysis Start Date minus Laboratory Receive Date

## 4.0 GENERAL SAMPLING TECHNIQUES AND CONSIDERATIONS

### 4.1 General Sampling Techniques

This section provides information on guidance documents available for collecting CLP Analytical Services samples. Samples should be collected according to the approved site specific Quality Assurance Project Plan and the Sampling Analysis Plan (EPA QA/R-5 "EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations" and EPA Order 5360.1). This document does not define specific sampling procedures for the CLP Analytical Services because specific sampling protocols depend on individual site conditions, Regional requirements, and DQOs. Regions may have their own specific requirements for individual sampling programs, the Regions are responsible for generating Region-specific sampling SOPs. Information regarding surface water, sediment, soil and groundwater sampling can be found in many documents including the following sources:

- *Compendium of ERT Surface Water and Sediment Sampling Procedures*, EPA/540/P-91/005.
- *Compendium of ERT Soil Sampling and Surface Geophysics Procedures*, EPA/540/P-91/006.
- *Compendium of ERT Groundwater Sampling Procedures*, EPA/540/P-91/007
- *Quality Assurance Sampling Plan for Environmental Response (QASPER) software, Version 4.1, ERT.*
- *Requirements for the Preparation of Sampling and Analysis Plans*, Draft, US Army Corps of Engineers, June 30, 1994, EM 200-1-3.

Other sources are available. This list is not exhaustive.

These documents, along with appropriate Regional guidance and procedures, should be consulted for detailed sample collection, preservation, handling and storing, equipment decontamination, and quality assurance/quality control procedures. When working with potentially hazardous materials, follow U.S. EPA and OSHA requirements, specific health and safety procedures, and Department of Transportation (DOT) requirements.

Regional sampling protocols and Regional QA guidelines should be consulted. Proper procedures for insuring good sampling results should be followed.

### 4.2 Special Sampling Considerations

This section provides general guidance for VOC, low concentration contaminant, and duplicate and split sample collection, along with procedures for sample compositing and mixing. The guidance provided in this section may be useful and appropriate for the collection of CLP Analytical Services samples.

The Regions should have developed specific SOPs to address the procedures for preserving samples in the field.

Testing and amelioration of carbonates, residual chlorine or oxidants in VOC samples and sulfides and residual chlorine in extractable fractions should be included in Regional guidance.

#### 4.2.1 Volatile Organic Compound Collection

When collecting samples for VOC analysis, care should be taken to prevent analyte loss by evaporation. The following procedures are designed to minimize sample contamination and analyte loss during aqueous and non-aqueous VOC sample collection. Also, be sure to follow Regional guidance to ensure that proper prepreservation treatment is accomplished (e.g., residual chlorine). See Technical Notes on Drinking Water Methods, EPA/600/R-94/173, page 53.

#### Aqueous VOC Sample Collection

- Rinse the vial with sample water prior to actual sample collection and preservation. See Section 3.8, Sample Preservation and Holding Times, and Exhibit 3-7.
- Avoid excessive aeration and agitation of the sample by pouring the sample slowly down the edge of the sample vial.
- Fill vial so that a reverse (convex) meniscus is present (in the case of water in a glass container).
- Place septum on the vial so that the Teflon side is in contact with the sample and then tighten the cap.
- Immediately invert the vial and lightly tap to locate air bubbles.
- If air bubbles are present, discard the sample and recollect the sample. Check the recollected sample for air bubbles. If air bubbles are present, additional sample water may be added to the vial in an attempt to eliminate the air bubbles. The presence of air bubbles after three consecutive attempts to rid the sample of the condition should result in the use of a new sample container and recollection of the sample. Regions vary in their approach to rinsing the sampling vial and recollecting the sample in the same vial. BE SURE TO FOLLOW REGIONAL GUIDANCE.
- Do NOT mix or composite samples.
- Immediately transfer the vial to the sample shuttle [device which contains a "set" of VOC vials] once it has been collected. Do not allow ice to touch the vials.

#### Solid VOC Sample Collection

- Minimize headspace as much as possible.
- Pack sample lightly with either a glass rod, Teflon spatula, or stainless steel spatula.
- Secure cap with Teflon-side of septum in contact with sample.
- Do NOT mix or composite samples.
- Immediately transfer the vial to the sample shuttle once it has been collected. Do not allow ice to touch the vials.
- Wipe outside of sample container to remove excess sample from threads to ensure a tight lid fit.

#### **4.2.2 Contaminant Sampling**

Some compounds can be detected in the ppb and/or ppt range. Extreme care must be taken to prevent cross-contamination of these samples. The following precautions should be taken when trace contaminants are of concern:

- Disposable gloves should be worn each time a different location is sampled.
- When collecting both surface water and sediments samples, surface water samples should be collected first. This reduces the chance of sediment dispersal into surface water, and the resulting loss of surface water sample integrity.

- Sampling should occur in a progression from the least to most contaminated area, if this information is known.
- Samplers should use equipment constructed of Teflon, stainless steel, or glass that has been properly precleaned for collecting samples for trace organics compound analyses. (A set of procedures for cleaning sampling equipment may be found in Regional guidance. *Equipment constructed of plastic or PVC should not be used to collect samples for trace organic compounds analyses.*

#### 4.2.3 Sample Compositing and Mixing

When compositing solid samples, (i.e., sediment, soil, sludge) for analysis of compounds present in trace quantities, a stainless steel or Teflon bowl and spatula should be used. Samples for VOC analysis should not be composited to minimize evaporation. The sample should be thoroughly mixed and divided into subsections in the compositing container. The procedure for sectioning is as follows:

- Roll the contents of the compositing container to the middle of the container and mix.
- Quarter the sample and move to the sides of the container.
- Mix each quarter individually and roll to the middle of the compositing container.
- Mix the sample once more, composite quarter subsamples, place in container.

The approximate quantity of each subsection should be recorded in the field logbook.

## 5.0 SAMPLE DOCUMENTATION

Each sample processed by the CLP must be properly documented to ensure timely analysis of all parameters requested and to support the use of the sample data in potential enforcement actions. **It is the sampler's responsibility to fill out all appropriate paperwork completely and correctly.** This section provides instructions for completing all CLP forms and other sample documentation. Each EPA Region may require additional documentation. It is important to follow both the national guidelines and Regional guidelines for CLP Analytical Services samples. Contact your RSCC for Region-specific instructions and guidance prior to the sampling activity. Contact the Region VII RSCC for information regarding sample documentation for the Rapid Turnaround Dioxin Analytical Service.

### 5.1 Case Number/Sample Delivery Group

A Case number is assigned by the CLASS contractor to CLP Analytical Services sampling events and is five digits in length. Each CLP Analytical Services sampling event receives a distinct Case number which helps maintain site confidentiality. (Contract laboratories should not know the site name for the samples they are analyzing in order to avoid potential conflict of interest problems.) The Case number also enables the CLASS contractor and the Region to easily track CLP Analytical Services sampling events. The Sample Delivery Group (SDG) is a unit within a Case that is used to identify a group of samples for delivery. An SDG is defined as one of the following, whichever comes first: all samples with a Case, or every set of 20 field samples within a Case, or the field samples in a Case which are received at a laboratory during a specified period of time, beginning with receipt of the first sample in the Case or SDG. Note: Laboratory QC sample frequencies are based on the SDG.

### 5.2 Sample Number

The CLP sample number is a unique number that identifies each sample under a CLP Analytical Services analytical program. A CLP Analytical Services sample is defined by one sample matrix at one concentration level from one station location for each individual or set of analytical fraction(s), provided the fractions are all requested from the same CLP Analytical Service. The sample number is preprinted on adhesive labels and is provided by your RSCC, who routinely orders them from the CLASS contractor. Exhibit 5-1 shows examples of CLP Analytical Service sample labels. Sample numbers are comprised of a Regional letter code and sequential sample numbering. Regional letter codes are listed in Exhibit 5-2. Use only the labels provided to the Region in which you are sampling. **It is your responsibility to assign this critical sample number correctly and to transcribe it accurately on the appropriate documentation.** Place the label on the appropriate sample container and transcribe the sample number onto the sample tag and TR/COC (Tracking Report Chain of Custody) form. The unique sample number must only be used for one sample. Destroy all unused labels to prevent duplication of sample numbers. Do not add digits or hyphens to the CLP sample numbers. If additional sample numbers are needed in the field, contact your RSCC. The sampler should consider placing clear tape over the adhesive labels as this procedure will help preserve the information on the adhesive labels. Samplers should attempt to use the provided CLP sample numbers in numerical order [as much as possible]. All samples must have sample numbers on the label and tag, if tags are used. The use of sample tags is highly recommended (see Section 5-3).

#### Organic Sample Numbers

Organic sample numbers are five characters long and have the format XXXXX. The first letter indicates the Region, the remaining letters and numbers are used for sequential sample numbering (see Exhibits 5-1 and 5-2). Organic sample numbers are preprinted on labels. For the organic fractions, there are ten labels four for semivolatiles (labeled extractables), two for volatiles, and four are blank (for pesticides/Aroclors and extra sample volume). Remember that the unique sample number must only be used for one sample. Destroy all unused labels to prevent duplication of sample numbers.



## Inorganic Sample Numbers

Inorganic sample numbers are six characters long and have the format MXXXXX. The "M" indicates that this sample is inorganic, the second letter indicates the Region, and the remaining letters and numbers are used for sequential sample numbering (see Exhibits 5-1 and 5-2). Inorganic sample numbers are preprinted on labels, seven labels per strip. Two labels are for total metals, two for cyanide and three blanks (for extra sample volume). According to CLP guidelines, each individual inorganic sample may be analyzed for total metals or dissolved metals, but not both. That is, samples collected for total metal and dissolved metal analyses must receive separate (unique) sample numbers. Remember that the unique sample number must only be used for one sample. Destroy all unused sample labels.

Exhibit 5-1. CLP Analytical Services Sample Labels

Organic	Inorganic
BLH01 - Semivolatile BLH01 - Semivolatile BLH01 - Semivolatile BLH01 - Semivolatile BLH01 - VOA BLH01 - VOA BLH01 - Pesticide Aroclor BLH01 - BLH01 [Blanks may be included]	MBJT01 - Total Metals MBJT01 - Total Metals MBJT01 - Cyanide MBJT01 - Cyanide MBJT01 MBJT01 MBJT01 [Blanks may be included]

Exhibit 5-2. CLP Analytical Services Regional Letter Codes

REGION	LETTER CODE	
	ORGANIC	INORGANIC
I	A	MA
II	B	MB
III	C	MC
IV	D	MD
V	E	ME
VI	F	MF
VII	G	MG
VIII	H	MH
IX	Y	MY
X	J	MJ

To support the use of sample data in potential enforcement actions, samples should be identified according to EPA National Enforcement Investigations Center (NEIC) sample control guidelines. NEIC recommends that samples other than *in situ* measurements (e.g., pH, temperature, conductivity) be identified with a sample tag. Each sample aliquot removed from a hazardous waste site to be transferred to a laboratory for analysis should, therefore, be identified with a sample tag. The sample tag is returned to the Region by the laboratory along with the corresponding data package as physical evidence of sample receipt and analysis.

Section 6.1, Sample Packaging, contains additional information on sample tags

Project Code <b>2</b> ZSMO.O		Station No. <b>3</b> 26		Mo./Day/Yea <b>4</b> 8/9/91		Time <b>5</b> 10:07		Designator: <b>6</b>	
								Comp.	Grab <b>x</b>
Station Location <b>7</b> MONITORING WELL #26 SPLIT SPOON #11				Sampler's (Signatures) <b>8</b> John James					
Tag No. 7712		Lab. Sample No.		Preservative: Y <input checked="" type="checkbox"/> N <input type="checkbox"/> <b>6</b>					
				<b>ANALYSES</b>					
				<b>10</b>					
Remarks: CASE NO 1746 SAMPLE NO MK501 <b>1</b>		BOD Antions Solides (TSS)(TDS)(SS)							
		COD, TOC, Nutrients							
		Phenolics							
		Metals							
		Cyanide						<b>x</b>	
		ABN							
		VOA organics							
		Pesticides							

#### Exhibit 5-4. Sample Tag Instructions

STEPS	INSTRUCTIONS
STEP 1	Under the "Remarks" heading, record the CLP Case number and sample number.
STEP 2	Record the project code (e.g., contract number, work assignment number, Interagency Agreement number, etc.) assigned by EPA.
STEP 3	Enter the station number assigned by the sampling team coordinator.
STEP 4	Record the month, day, and year of sample collection.
STEP 5	Enter the military time of sample collection, e.g., 13:01 for 1:01 p.m.
STEP 6	Place an "X" to indicate composite or grab sample.
STEP 7	Record the station location (description) as specified in the project plan.
STEP 8	Sign the sample tag with your name.
STEP 9	Place an "X" in the box next to "yes" or "no" to indicate if a preservative was added to the sample.
STEP 10	Under "analyses," place an "X" in the box next to the parameters for which the sample is to be analyzed.
Note: Leave the box for "laboratory sample number" blank.	

#### 5.4 Traffic Report/Chain-of-Custody Forms

The organic and inorganic traffic report/chain-of-custody (TR/COC) forms enable the CLASS contractor and the Region to track CLP Analytical Services samples and ensure that the samples are shipped to the appropriate contract laboratory. **The TR/COC form is functionally similar to a packing slip that accompanies a shipment of goods.** The TR/COC form includes a chain-of-custody record located at the bottom of the form. The form is used as physical evidence of sample custody. EPA-NEIC guidelines specify that official custody of samples must be maintained and documented from the time of collection until the time the samples are introduced as evidence in the event of litigation. **The sampler is responsible for the care and custody of the sample until sample shipment.** A sample is considered to be in your custody if any of the following criteria are met:

- The sample is in your possession or is in your view after being in your possession;
- The sample was in your possession and then locked up or sealed to prevent tampering; or
- You have placed the sample in a secured area.

Document CLP Analytical Services organic, inorganic samples on separate CLP TR/COC forms. TR/COC forms must be completed for every shipment of CLP Analytical Services samples to a contract laboratory. **Use indelible ink only, no pencil (a ball point pen is best)!** Make corrections by drawing a line through and initialing and dating the error, then enter the correct information. **Erasures are not allowed!** Each TR/COC form should be imprinted. Each TR/COC form documents up to 10 samples per Case number and sample shipment.

A separate TR/COC form must accompany each cooler for each daily shipment. The TR/COC forms must address all samples in that cooler, but not address samples in any other cooler. This practice maintains the chain-of-custody for all samples in case of mis-shipment.

Instructions summarizing CLP sample volumes, packaging and reporting requirements are printed on the back of the TR/COC forms.

Any errors on the TR/COC forms should be immediately reported to the authorized RSCC or CLASS personnel who can then inform the laboratory. The faster such problems are identified, the faster they can be corrected and critical delays in sample analysis may be avoided. See Section 7.0, Communication Network.

Exhibits 5-5, and 5-6 are examples of completed TR/COC forms. Exhibit 5-7 provides step-by-step instructions for filling out the organic and inorganic TR/COC forms. Exhibit 5-8 provides purpose codes for the forms. Samplers may find it helpful to carry these instructions to the field. Site managers should consider appending these instructions to the SAP.

After you have properly completed the TR/COC form, place the **bottom** two copies (white and yellow for organic and inorganic samples) in a plastic bag, then tape the bag to the inside of the sample cooler lid. The second copy (pink for organic and inorganic samples) must be returned to the CLASS contractor within five days of sample shipment. The address of the CLASS contractor is provided in Exhibit 7-3. The top copy (blue for organic and green for inorganic) should be sent to designated Regional personnel.

**Note: All samples in a cooler must be recorded on a TR/COC form inside the cooler and each unique sample number should be listed on only one TR/COC form.** (In the case where aliquots of the same sample are collected at different times [as may occur when well development is very slow] and shipped sequentially, fractions may be given different sample numbers. If fractions are given unique sample numbers, it will be necessary for the Region to track the fractions and maintain the knowledge that the fractions are from the same sample.) If all containers necessary for the analysis of 10 samples cannot fit into one cooler, divide samples into more coolers, making sure that all containers for each sample are in the same cooler. Place corresponding sample documentation into each cooler. **IF MORE THAN ONE TR/COC FORM IS USED FOR THE SAMPLES IN ONE COOLER**, then all of the forms must have complete header information and signatures.

## 5.5 Field Operations Records Management System

In an effort to streamline the resource intensive field documentation functions that occur during sampling activities, EPA-NEIC, at the request of the AOC, developed the Field Operations Records Management System II (FORMS II). FORMS II is software that facilitates the capture of field information during sampling events, and automates the production of bottle labels, sample tags, bottle-specific custody seals, chain-of-custody records, cooler seals, PRP sample receipt records, and field reports. FORMS II enables field personnel to download data to the laboratory, RSCC, and Regional users. FORMS II design features include the following:

### Hardware portability/compatibility/versatility

Because field samplers cannot guarantee access to an AC power source or a stable computer working environment, FORMS II is compatible with existing portable hardware including portable computers, portable printers, and portable bar code scanning devices. While FORMS II is mouse-compatible, unknown field conditions prohibit FORMS II reliance on a mouse, but other pointing devices may be useful.

FORMS II uses hardware units specially selected to minimize the likelihood of failure or downtime as a result of adverse field conditions.

### Bar code application


FORMS II uses bar code technology to accelerate the sample packing process for sample shipment to CLP laboratories. In addition, laboratory personnel may use the sample bottle bar codes to facilitate receipt and associated records management activities.

### Flexibility for multiple samplers/samples

Field samplers and field sampling organizations often use unique numbering and identification schemes in addition to the CLP sample numbers when collecting samples. They also vary in their approach to many other activities. For that reason, FORMS II design includes choices for: identification scheme, activity names, labeling information, and number and types of labels/tags/seals.

#### Sample Definitions

FORMS II design is based on field sample, QC sample, and analytical fraction definitions that are consistent with those provided in Section 3.0, Sample Collection. FORMS II improves field time management, standardizes information management, and captures collection information in an electronic format early in the field sampling process. Estimated training time for new FORMS II users is less than two hours. FORMS II is currently managed by AOC. If you are interested in using FORMS II, please contact AOC at (703) 603-8870.

		United States Environmental Protection Agency Contract Laboratory Program				<b>Organic Traffic Report &amp; Chain of Custody Record</b> (For Organic CLP Analysis)		SAS No. (If applicable):	1	Case No.	2		
1. Project Code 21SM100		Account Code 41502		2. Region No. 1	3. Sampling Co. ACE	4. Date Shipped/Carrier 8/10/92 FEDX	6	8. Matrix (Enter in Column A)		7. Preservative (Enter in Column D)			
Regional Information				3	Sampler (Name) JOHN SMITH		4	Airbill Number 123-456-7890		25			
Non-Superfund Program				Sampler Signature John Smith		5. Ship to LAB A 100 ARROW WAY HOPE, VA 22141		7		1. Surface Water 2. Ground Water 3. Leachate 4. Field OC 5. Soil/Sediment 6. Oil (High only) 7. Waste (High only) 8. Other (Specify in Column A)			
Site Name SAM'S DUMP				3. Purpose Lead <input type="checkbox"/> CLEM PA <input type="checkbox"/> PA REM <input type="checkbox"/> REM RI <input type="checkbox"/> RI SI <input checked="" type="checkbox"/> SI FED <input type="checkbox"/> FED		Long Term Action ES <input type="checkbox"/> ES RAD <input type="checkbox"/> RAD RA <input type="checkbox"/> RA O&M <input type="checkbox"/> O&M NPLO <input type="checkbox"/> NPLO		ATTN: SAMPLE CUSTODIAN		1. HCl 2. HNO3 3. NaHSO4 4. H2SO4 5. Ice only 6. Other (Specify in Column D) N. Not preserved			
City, State BOSTON, MA		Site Split ID 22											
CLP Sample Numbers (from labels)	A. Matrix (from Box 6) Other	B. Conc Low Med High	C. Sample Type Comp Grab	D. Preservative (from Box 7) None	E. RAS Analysis VOA <input type="checkbox"/> BNA <input type="checkbox"/> H <input type="checkbox"/> A <input type="checkbox"/> J <input type="checkbox"/> TOX		F. Regional Specific Tracking Number or Tag Numbers		G. Station Location Identifier	H. Mo/Day/Year/Time Sample Collection	I. Corresponding CLP Inorganic Sample No.	J. Sampler Initials	K. Field QC Qualifier B - Blank, C - Spike, D - Duplicate, E - Retest, F - Portion Size, G - Matrix QC Sample
AFR23	2	L	G		X			A7712-A7713	MCL-MW-01	8/9/92 1330	MACC22	Qd	-
AFR24	3	L	G		X	X		A7714-A7717	MCL-SW-02	8/9/92 1345	MACC23	Qd	-
AFR25	4	L	G		X	X		A7718-A7721	MCL-SSA-04	8/9/92 1400	MACC24	Qd	D
AFR26	2	L	G		X			A7722-A7723	MCL-MW-02	8/9/92 1430	MACC25	Qd	-
8	9	10	11	12	13	14	15	16	17	18	19		
Shipment for Case Complete? (Y/N)		Page 21 of 1	Sample(s) to be Used for Laboratory QC AFR24, AFR25		Additional Sampler Signatures		Chain of Custody Seal Number(s) 874327		23		24		

Relinquished by: (Signature) 26 John Smith		Date / Time 8/9/92 1630	Received by: (Signature)		Date / Time	Received by: (Signature)	
Relinquished by: (Signature)		Date / Time	Received by: (Signature)		Date / Time	Received by: (Signature)	
Relinquished by: (Signature)		Date / Time	Received for Laboratory by: (Signature)		Date / Time	Remarks: Is custody seal intact? Y/N/none	

DISTRIBUTION

Blue - Region Copy

White - Lab Copy for Return to Region

Pink - SMO Copy

Yellow - Lab Copy for Return to SMO

EPA Form 816-2

SEE REVERSE FOR ADDITIONAL STANDARD INSTRUCTIONS  
SEE REVERSE FOR PURPOSE CODE DEFINITIONS

Exhibit S-5. Organic TRCOC Form Example

## Exhibit 5-5. Organic TR/COC Form Example (Continued)

### Organic Traffic Report/Chain of Custody Form Instructions

This form replaces both the individual Traffic Report and EPA Chain of Custody Record.

Water Samples	Required Volume	Container Type
Extractable Analysis (Low Level)	1 Gallon	1 X 4 Liter Amber Glass Bottle OR 2 X 80 oz. Amber Glass Bottle
Extractable Analysis	1 Gallon	4 X 1 Liter Amber Glass Bottles
Volatile Analysis (Low Level)	60 ml	32 oz. Wide-Mouth Glass Jar OR 2 X 40-ml Glass Vials



\*All Medium and High Level Samples Must be Sealed in Metal Can for Shipment

Soil/Sediment Samples	Required Volume	Container Type
Extractable Analysis (Low or Medium Level)	6 oz 240 ml	1 X 8-oz Wide-Mouth Glass Jar OR 1 X 4-oz Wide-Mouth Glass Jar
Volatile Analysis (Low or Medium Level)		2 X 20-ml Wide-Mouth Glass Vials

100% VOCs are under study, subject to change, check to ensure proper shipping

#### HIGH CONCENTRATION SAMPLE COLLECTION REQUIREMENTS

Liquid or Solid Samples	Required Volume	Container Type
Extractable and Volatile Analysis	6 oz	1 X 8-oz Wide-Mouth Glass Jar

#### 1. Organic Sample Collection Requirements

- Please indicate which sample(s) are to be used for laboratory GC (Matrix Spike/Matrix Spike Duplicate).
- Ship medium and high concentration samples in metal cans.
- Aqueous samples require one triple-volume sample per twenty for Matrix Spike/Matrix Spike Duplicate.
- Oily samples can not be analyzed under the Contract Laboratory Program Analytical Services (CLPAS) program.

#### 2. Cooler and Sample Documentation

- Complete all sections of the Traffic Report/Chain of Custody Form - Press firmly with a ball point pen to ensure that carbon copies are legible. Check the information and correct any errors.
- Please remember to complete the Chain of Custody information on the form.
- Seal the two sets of laboratory Traffic Report/Chain of Custody Form copies in a plastic bag. Include a return address and a method for returning the cooler. Tape bag under cooler lid.
- Seal each container in a plastic bag.
- Pack medium and high concentration samples in metal cans.
- Cool low waters to 4° C. Cooling of low soils is optional. Do not cool medium or high concentration waters and soils.
- Separate and surround cooler contents with vermiculite or equivalent packaging.
- Seal the cooler, overlapping the lid and body with custody seals.
- Mail CLASS the pink copy of the Traffic Report/Chain of Custody Form within 5 days.

#### 3. Sample Shipment and Reporting

- All relevant Department of Transportation regulations must be followed when shipping samples.
- PHONE IN ALL SHIPMENTS IMMEDIATELY TO CLASS (or to RSCC, if instructed)

Required information:

Case Number  
Date shipped  
Number of samples by concentration, matrix and analyses.  
Carrier and airbill number  
Next planned shipment

Leave your name and a number where you can be reached.

- Information for SATURDAY DELIVERIES must be phoned in by 3:00 PM (Eastern) the preceding FRIDAY.
- Report any delays or changes of scope (i.e., changes in number of samples to be collected, matrix changes, etc.)
- CALL IF YOU HAVE ANY QUESTIONS

Contract Laboratory Analytical Services Support  
300 North Lee Street  
Alexandria, VA 22314  
Phone: (703) 519-1200  
FAX: (703) 519-8626

Lead	Early Action	Purpose Codes	Long-Term Action
SF = Superfund	CLEM = Classical Emergency	SI = Site Inspection	FS = Feasibility Study
PRP = Commercial Potentially Responsible Party	PA = Early Action Preliminary Assessment	ESI = Expanded Site Inspection	RD = Remedial Design
ST = State	REM = Removal	RI = Remedial Investigation	RA = Remedial Action
FED = Federal Facility			O&M = Operation & Maintenance
			NPLD = National Priorities List Deletion

★ U.S. GPO: 1990-364-781



United States Environmental Protection Agency  
National Laboratory Program

**Inorganic Traffic Report  
& Chain of Custody Record**  
(For Inorganic CLP Analysis)

SAS No.  
(If applicable)

1

Case No.

18025

2

1. Project Code 2184100	2. Account Code 41502	3. Region No. 1	4. Sampling Co. ACE	5. Date Shipped 8/9/92	6. Carrier FDX
Regional Information		3. Sampler (Name) JOHN SMITH		4. Airbill Number 321-687-1344	
Non Superfund Program		5. Sampler Signature John Smith		7. Preserve (Enter in Column D) 1. Surface Water 2. Ground Water 3. Leachate 4. Pesticide 5. Sediment 6. Oil (High only) 7. Waste (High only) 8. Other (specify in Column A)	
Site Name SAM'S DUMP		6. Ship To LAB 2 100 APRIL WAY BOSTON, MA 02104		7. Preserve (Enter in Column D) 1. HCl 2. HNO <sub>3</sub> 3. NaOH 4. H <sub>2</sub> SO <sub>4</sub> 5. K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> 6. Ice only 7. Other (specify in Column D) 8. Not preserved	
City/State BOSTON, MA		7. Site Spill ID 12		ATTN: SAMPLE CUSTODIAN	

CLP Sample Number (from label)	A. Matrix (from Box 1)	B. Conc. Low Med High	C. Sample Type Comp. Grab	D. Preserve (from Box 2)	E. RAS Analysis			F. Regional Specific Tracking Number or Tag Number	G. Station Location Identifier	H. Mo/Days Year/Time Sample Collection	I. Corresponding CLP Organic Sample No.	J. Sampler Initials	K. Field QC Qualifier
MAC022	2	L	G	2/3	X	X		48711-48712	MCL-MW-01	8/9/92 13:35	AFR24	gd	-
MAC023	2	L	G	2	X			48713	MCL-MW-02	8/9/92 13:30	AFR24	gd	-
MAC024	2	L	G	2/3	X	X		48714-48717	MCL-MW-04	8/9/92 14:25	AFR25	gd	S
MAC025	2	L	G	2	X			48718	MCL-MW-02	8/9/92 15:00	AFR26	gd	-
8	9	10	11	12				14	15	16	17	18	19

Shipment for Case Complete? (Y/N)	Page 21	Samples to be used for Laboratory QC	Additional Sampler Signatures	Chain of Custody Seal Number(s)
20	1 of 1	MAC024	22	674327

**CHAIN OF CUSTODY RECORD**

Relinquished by (Signature) 26 John Smith	Date / Time 8/9/92 15:30	Received by (Signature)	Relinquished by (Signature)	Date / Time	Received by (Signature)
Relinquished by (Signature)	Date / Time	Received by (Signature)	Relinquished by (Signature)	Date / Time	Received by (Signature)
Relinquished by (Signature)	Date / Time	Received for Laboratory by (Signature)	Date / Time	Remarks	Is custody seal intact? Y/N/None

REDISTRIBUTION

Green - Region Copy

White - Lab Copy for Return to Region

Pink - SMO Copy

Yellow - Lab Copy for Return to SMO

EPA Form 9-19-1

SEE REVERSE FOR ADDITIONAL STANDARD INSTRUCTIONS  
SEE REVERSE FOR PURPOSE CODE DEFINITIONS

Exhibit S-6. Inorganic TR/COC Form Example



## Exhibit 5-6. Inorganic TR/COC Form Example (Continued)

### Inorganic Traffic Report/Chain of Custody Form Instructions

This form replaces both the individual Traffic Report and EPA Chain of Custody Record.

Water Samples	Required Volume	Container Type	Soil/Sediment Samples	Required Volume	Container Type
Metals Analysis (Low Level)	1 Liter	1 X 1-Liter Polyethylene Bottle OR 2 X 500-ml. Polyethylene Bottle	Metals and Cyanide (CN <sup>-</sup> ) Analysis (Low or Medium Level*)	6 oz.	1 X 8-oz. Wide-Mouth Glass Jar OR 2 X 4-oz. Wide-Mouth Glass Jars
Metals Analysis (Medium Level*)	16 oz.	1 X 16-oz. Wide-Mouth Glass Jar			
Cyanide Analysis (Low Level)	1 Liter	1 X 1-Liter Polyethylene Bottle OR 2 X 500-ml. Polyethylene Bottle			
Cyanide Analysis (Medium Level*)	16 oz.	1 X 16-oz. Wide-Mouth Glass Jar			



\*All Medium and High Level Samples Must be Sealed in Metal Can for Shipment

#### HIGH CONCENTRATION SAMPLE COLLECTION REQUIREMENTS

Liquid or Solid Samples	Required Volume	Container Type
Metals and Cyanide* Analysis	6 oz.	1 X 8 oz. Wide-Mouth Glass Jar

#### 1. Inorganic Sample Collection Requirements

- Please indicate which sample(s) are to be used for laboratory QC (Matrix Spike/Duplicate).
- Aqueous samples require one double-volume sample per twenty for laboratory Matrix/Spike Duplicate.
- Preserve low level water samples:
  - Total metals Preserve with HNO<sub>3</sub> to pH ≤ 2
  - Dissolve metals Preserve with HNO<sub>3</sub> to pH ≤ 2 after filtering through a 0.45 µm filter.
  - Cyanide Preserve with 10 N NaOH to pH ≥ 12
- Oily samples can not be analyzed under the Contract Laboratory Program Analytical Services (CLPAS) program.
- Ship medium and high concentration samples in metal cans.

#### 2. Cooler and Sample Documentation

- Complete all sections of the Traffic Report/Chain of Custody Form - Press firmly with a ball point pen to ensure that carbon copies are legible. Check the information and correct any errors.
- Please remember to complete the Chain of Custody information on the form.
- Seal the two sets of laboratory Traffic Report/Chain of Custody Form copies in a plastic bag. Include a return address and a method for returning the cooler. Tape bag under cooler lid.
- Seal each container in a plastic bag.
- Pack medium and high concentration samples in metal cans.
- Cool low waters to 4° C. Cooling of low soils is optional. Do not cool medium or high concentration waters and soils.
- Separate and surround cooler contents with vermiculite or equivalent packaging.
- Seal the cooler, overlapping the lid and body with custody seals.
- Mail CLASS the pink copy of the Traffic Report/Chain of Custody Form within 5 days.

#### 3. Sample Shipment and Reporting

- All relevant Department of Transportation regulations must be followed when shipping samples.
- PHONE IN ALL SHIPMENTS IMMEDIATELY TO CLASS (or to RSCC, if instructed)
- Required information:
  - Case Number
  - Date shipped
  - Number of samples by concentration, matrix and analyses
  - Carrier and airbill number
  - Next planned shipment
- Leave your name and a number where you can be reached
- Information for SATURDAY DELIVERIES must be phoned in by 3:00 PM (Eastern) the preceding FRIDAY.
- Report any delays or changes of scope (i.e., changes in number of samples to be collected, matrix changes, etc.)
- CALL IF YOU HAVE ANY QUESTIONS
  - Contract Laboratory Analytical Services Support
  - 300 North Lee Street
  - Alexandria, VA 22314
  - Phone: (703) 519-1200
  - FAX: (703) 519-8626

Lead	Early Action	Purpose Codes	Long Term Action
SF = Superfund	CLEM = Classical Emergency	SI = Site Inspection	FS = Feasibility Study
PRP = Commercial Potentially Responsible Party	PA = Early Action Preliminary Assessment	ESI = Expanded Site Inspection	RD = Remedial Design
ST = State	REM = Removal	RI = Remedial Investigation	RA = Remedial Action
FED = Federal Facility			O&M = Operation & Maintenance
			NPLD = National Priorities List Deletion

**Exhibit 5-7. Organic and Inorganic Traffic Report/Chain-of-Custody Forms Instructions**

STEP	INSTRUCTIONS
STEP 1	The SAS Order number is no longer applicable. Leave this box blank.
STEP 2	Record the Case number that has been assigned to the sampling event.
STEP 3	Transcribe the project codes and site information. Enter the project and account codes assigned to the project by the RSCC's or EPA Site Managers. Record the site name, city, state, and site spill ID (assigned by your Region). This part of the form is desensitized and will not print on the laboratory copies. All site information must be kept confidential.
STEP 4	Record your Region number and the name of your sampling company. Print your name and include your signature in the space following. Additional space for sampler signatures is provided for in the area designated as Step 23.
STEP 5	Place a check mark in the appropriate box for funding lead under the column labeled "Lead." Place another check mark under either the "Early Action" or "Long-Term Action" columns for sampling effort. Two boxes must be checked in this area. Note that RCRA is an example of a federal lead sampling activity. Purpose codes are described in Exhibit 5-8.
STEP 6	Record the date shipped, the carrier name (e.g., Federal Express, Parolator or Airborne) and the air bill number.
STEP 7	Record the name and full address of the contract laboratory. Enter the name of the sample custodian or CLP contact. If contact name is unknown, write "CLP Sample Custodian."
STEP 8	Transcribe the CLP sample number from the preprinted sample labels exactly as it appears. Do not add hyphens, extra zeros, characters, or digits.
STEP 9	Record the appropriate matrix code from the choices listed in box number 6 on the form. If the Region is shipping a quality control (QC) sample such as a field blank, coolant blank, trip blank, spike, duplicate, or performance evaluation sample, then "Field QC" should be entered as the matrix for that sample. However, if the Region wishes to keep the QC sample blind to the laboratory (this is recommended), then the sampler should enter either "1," "2," or "3" for water QC samples, and "5" for soil/sediment QC samples as the matrix code in Column A, "Matrix."
STEP 10	Enter the estimated sample concentration. For organic samples, enter "L" for low/medium aqueous samples, "L" for low concentration solid samples, and "M" for medium concentration solid samples. For inorganics, enter "L" for low concentration samples, "M" for medium concentration, and "H" for high concentration.
STEP 11	Enter the sample type, either composite or grab.
STEP 12	Record the type of preservative, using the codes from box number 7 on the form.
STEP 13	In the analysis columns, make a check mark for each fraction to be analyzed. (It is not necessary to write the number of sample containers used.) Organics fractions are volatiles, semivolatiles, and pesticides/Aroclors; Inorganic fractions are total metals, dissolved metals, and cyanide. For each individual inorganic sample, you may request either total metal or dissolved metal analyses, but not both. That is, samples collected for total metal and dissolved metal analyses must receive separate (unique) sample numbers. Note: Your form may also contain future or recently discontinued fraction analyses.
STEP 14	Transcribe the Region-specific tracking numbers or tag numbers designated by the RSCC. If possible, all tag numbers for each CLP sample should be on one line. If several tags with consecutive numbers are used for one sample, the first number must be completely transcribed. Remaining tag numbers in the sequence can either be represented by including only those numbers that are unique (separated by commas) or by listing the first and last numbers of the sequence, separated by a dash. The TR/COC form entries should make it clear which tag number corresponds to which fraction.
STEP 15	Enter the station location number.
STEP 16	Record the month, day, year, and time, in military style (e.g., 1600 hours = 4:00 p.m.), of sample collection. This may make field QC samples (e.g., duplicates) non-blind to the laboratory.
STEP 17	Enter the corresponding organic or inorganic CLP sample number, if applicable.
STEP 18	Enter your initials.


# **Exhibit 5-8. Purpose Codes**

FUNDING ACTIVITY	CODE	DEFINITION
Funding Lead	SF PRP ST FED	Superfund Potentially Responsible Party State Federal
Early Action	CLEM PA REM RI SI ESI	Classic Emergency Preliminary Assessment Removal Remedial Investigation Site Inspection Expanded Site Inspection
Long-Term Action	FS RD RA O&M NPLD	Feasibility Study Remedial Design Remedial Action Operations and Maintenance National Priorities List Delete

## **5.6 Custody Seal**

The custody seal is used to seal sample containers before they are placed into the cooler. Custody seals are also placed across the cooler opening after the cooler has been properly secured. The purpose of a custody seal is to indicate that the sample has not been tampered with prior to analysis. Therefore, for potential litigation purposes, you must sign and date the custody seal. It is a good practice to place the seal so that it is the signature that would be broken if the sample/cooler were opened (e.g., place the signature across the cooler/sample opening). Contact your authorized requestor or RSCC to obtain custody seals. Note: The space for "Sample No." does not need to be filled out on custody seals placed across the cooler opening. An example of a signed custody seal is shown in Exhibit 5-9. Because the use of custody seals varies between Regions, always refer to Regional guidance.

## **Exhibit 5-9. Custody Seal**

 UNITED STATES ENVIRONMENTAL PROTECTION AGENCY OFFICIAL SAMPLE SEAL	SAMPLE NO.	DATE	SEAL BROKEN BY	DATE	
	MTR 501				8/19/91
	SIGNATURE				John Jones
PRINT NAME AND TITLE					
JOHN JONES		TECHNICIAN			

## 6.0 SAMPLE PACKAGING AND SHIPPING

### 6.1 Sample Packaging

Follow all state and Federal regulations governing environmental sample packaging and shipment. Ship according to U.S. Department of Transportation (DOT) and International Air Transportation Association (IATA) regulations. The following sample packaging and shipping procedures need to be considered as minimum requirements. For some samples and shipping situations, these requirements may need to be exceeded.

- The site name should not appear on any documentation sent to the CLP laboratory.
- Aqueous samples for inorganic samples and volatile organic analysis may require chemical preservation. Note that the Regions may have slightly different requirements for the preservation of samples for volatile analysis, so Regional requirements should be consulted. Refer to Section 3.8, Sample Preservation and Holding Times, for these techniques before packaging.
- Check all lids/caps to make sure they are tight and will not leak. Place a completed custody seal over each container lid/cap, except for vials for volatile samples where the custody seal must be wrapped around the lid. (Note that the Regions may have slightly different requirements for placing custody seals and using tags, so Regional requirements should also be consulted. For custody seals, the objective is to place the seals in such a way that sample containers cannot be opened or tampered with without breaking the seal).
- Make sure sample labels are intact and covered with a piece of clear tape for protection. Tie on completed sample tags. Although there are no procedural requirements for tying on sample tags, a recommended approach is to tie the tag onto the sample bottle with a string by wrapping the string around the neck of the sample bottle and then tying the string into a knot.
- Enclose the sample container in clear plastic bag and seal the bag. Make sure the sample tags and labels are visible. See Exhibit 6-1. Note that if bubble wrap or other wrapping material will be placed around the labeled and tagged containers, write the sample number and fraction (e.g., "BLH01-VOCs") so that it is visible on the outside of the wrap, and then place the wrapped container in a clear plastic bag and seal the bag.
- Make sure that all samples that need to be kept cold ( $4 \pm 2^\circ\text{C}$ ) have been thoroughly cooled before placing in packing material so that the packing material serves to insulate the cold. Change the ice prior to shipment as needed. Ideally, pack the cooled samples into shipping containers that have already been chilled.
- Any soil/sediment samples suspected to be of medium/high concentration or containing dioxin must be enclosed in a metal can with a clipped or sealable lid (e.g., paint cans) to achieve double containment of those samples. Place suitable absorbent packing material around the sample container in the can. Make sure sample is securely stored in can and the lid is sealed. Label the outer metal container with the sample number and fraction of the sample inside. See Exhibit 6-1.
- Use a CLEAN waterproof metal or hard plastic ice chests or coolers in good repair for shipping samples. Remove the inapplicable previous shipping labels. Make sure any drain plugs are shut and seal plugs shut on the inside and outside with a suitable tape such as duct tape. Line the cooler with plastic (e.g., large heavy-duty garbage bag) before inserting samples.
- Ship samples at  $4^\circ \pm 2^\circ\text{C}$ , place double-bagged ice on top of samples. Ice must be sealed in double plastic bags to prevent melting ice from soaking the packing material. Loose ice must not be poured into the cooler.

- It is good practice to conduct an inventory of sample numbers, fractions, and containers when placing samples into the coolers, and then check the inventory against the corresponding TR/COC form before sealing the cooler to make sure that all samples and containers are present.
- Pack the lined shipping containers with noncombustible, absorbent packing material such as vermiculite or rock wool. Place the packing material on the bottom of the shipping container (inside the plastic liner) and around sample bottles or metal cans to avoid breakage during shipment. Never use earth, ice, paper, or styrofoam to pack samples. Earth is a contaminant, melted ice may cause complications and allow the sample containers to bang together when the shipping container is moved, and styrofoam presents a disposal problem (it also may easily blow out of the shipping container at the site).
- For samples that need to be shipped at  $4^{\circ} \pm 2^{\circ}\text{C}$ , place double-bagged ice on top of samples and fill remaining space with packing material. Note that if sample bottles have been protected with packaging material such as bubble wrap, then some double-bagged ice or ice packs may also be placed between samples.
- Use tape to securely fasten the top of the plastic used to line the shipping container. It is a good idea to then place a completed custody seal around the top of the bag which contains the sample in case the outer seals placed across the cooler lid are inadvertently damaged during shipment.
- Enclose all sample documentation (i.e., TR/COC, other chain-of-custody forms, and cooler return shipping documents) in a waterproof plastic bag, and tape the bag to the underside of the cooler lid. See Exhibit 6-2. This documentation should address all samples in the cooler, but not address samples in any other cooler. If more than one cooler is being used, place separate sample documentation in each cooler.
- Instructions for returning the cooler should be documented inside the cooler lid. Write a return name and address for the sample cooler on the inside of the cooler lid in permanent ink to ensure return of the cooler.
- Tape the cooler shut using strapping tape over the hinges. Place completed custody seals across the top and sides of the cooler lid so that lid cannot be opened without breaking the seal. See Exhibit 6-3.
- Place clear tape over the seal to prevent inadvertent damage to the seal during shipment. Do not place clear tape over the seals in a manner that would allow the seals to be lifted off with the tape and then reattached without breaking the seal.

Exhibit 6-1. Sample Packaging

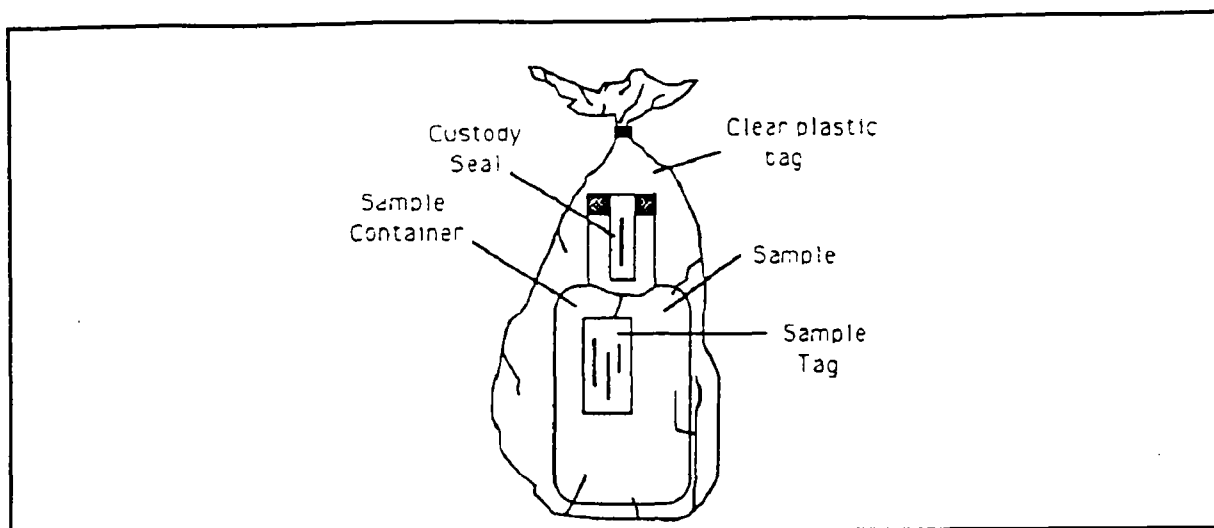
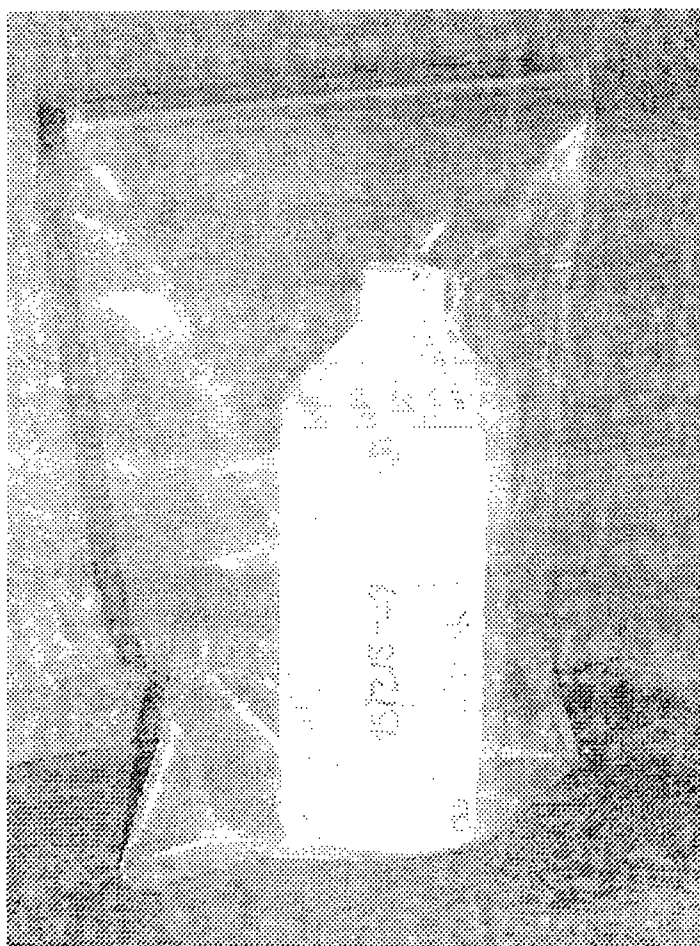
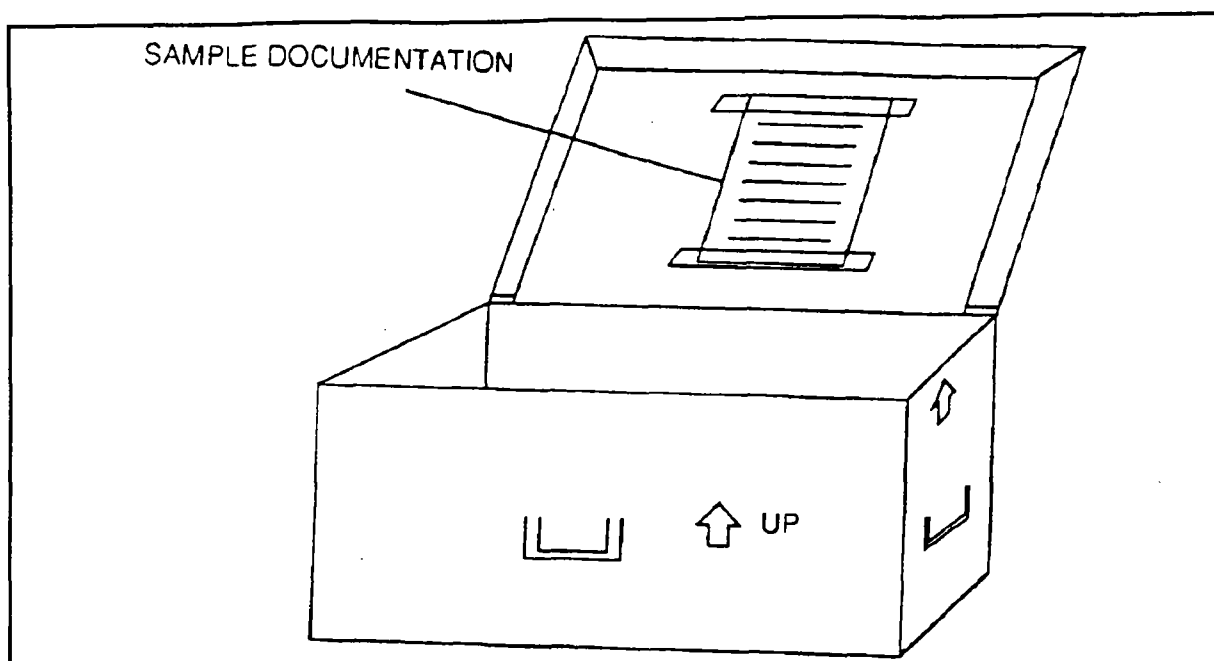


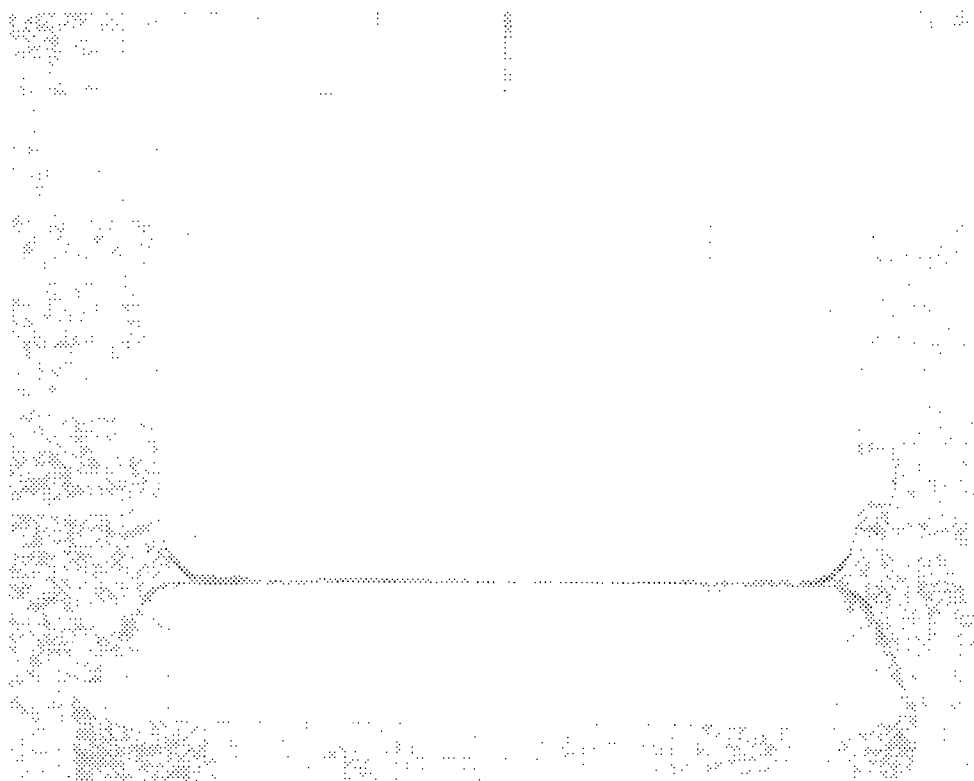
Exhibit 6-1a. Sample Packaging



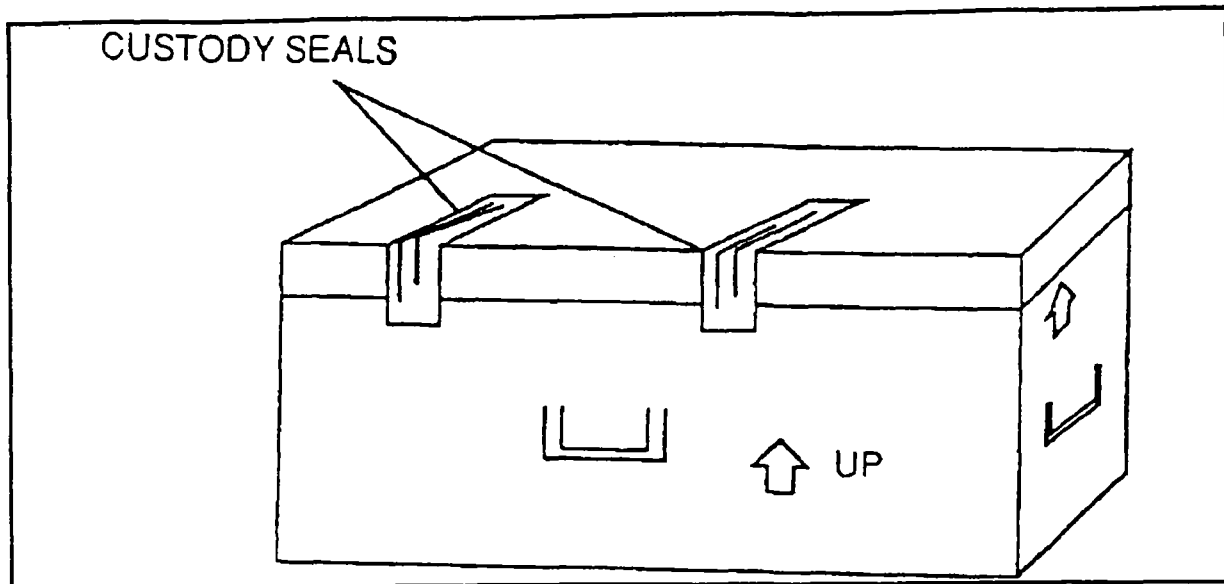
**Exhibit 6-2. Sample Cooler With Documentation**



**Exhibit 6-2a. Sample Cooler With Documentation**



**Exhibit 6-3. Sealed Cooler**



### 6.2 Sample Shipping

Clearly label cooler and fill out appropriate shipping papers. Exhibit 6-4 shows the top of a cooler ready to be shipped.

- Place return address labels clearly on the outside of the cooler.
- If more than one cooler is being delivered to a laboratory, mark each cooler as "1 of 2," "2 of 2," etc. An air bill should be filled out for each cooler being shipped. When addressing the air bill to ship samples, identify the recipient as the "sample custodian."
- Ship samples through a commercial carrier, such as Federal Express, Purolator, or equivalent.
- Fill out all required government and commercial carrier shipping papers according to DOT and IATA commercial carrier regulations.
- Ship all samples by overnight delivery, in accordance with DOT and IATA regulations.

### 6.3 Potential Sampling Problems

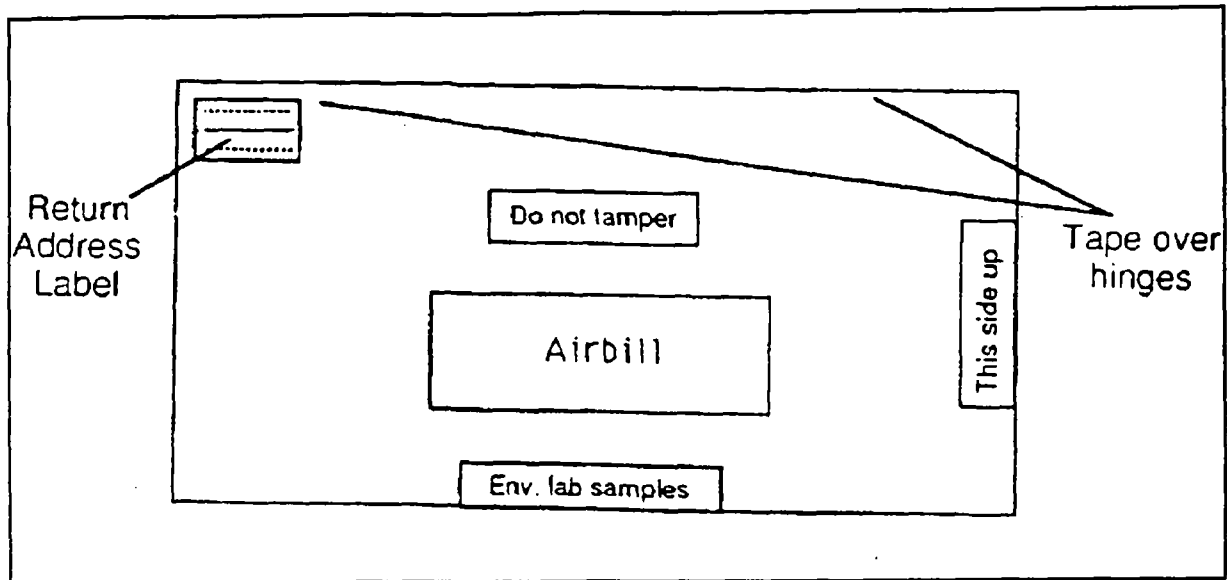
Sometimes problems arise during sampling from improper sampling practices or other reasons. Some common problems to watch out for are:

- Filling out paperwork incorrectly or incompletely.
- Using the wrong Case number.
- Collecting less than the required sample volume.



- Shipping samples to the wrong laboratory.

**Exhibit 6-4. Top of Cooler**



- Assigning the same CLP sample number to dissolved and total metals water samples collected from the same location.
- Using incorrect sample containers.
- Improperly filling or packing sample containers.
- Preserving sample with incorrect preservative.
- Improperly labeling cooler.

These problems may delay sample analysis. If any of these problems occur, contact your RSCC or CLASS Coordinator immediately for instructions.

#### **6.4 Reporting Sample Shipment**

Notify the authorized RSCC or CLASS personnel, as directed, of all sample shipments on the day of shipment. This notification enables the CLASS contractor to track the shipment of samples from the field to the laboratory and ensure timely laboratory receipt of samples. When calling the CLASS contractor [General number: (703) 519-1200], provide the following information:

- Your name, phone number, and Region.
- Case number of the project.

- Exact number(s) of samples (not number of containers), matrix(ces) and concentration(s) of samples shipped. Type of analysis required.
- Laboratory(ies) to which samples were shipped.
- Carrier name and air bill number(s) for the shipment.
- Method of shipment (e.g., overnight, two day).
- Date of shipment.
- Suspected contaminants associated with the samples or site (e.g., dioxin, radio chemicals).
- Information on completions, changes, delays, continuations, etc., pertinent to the Case and sampling project.

Sample shipments made after 5 p.m. EST should be scheduled with the CLASS contractor at the start of business the next day (8 a.m. EST). **You must notify the CLASS contractor by 3 p.m. EST Friday for sample shipments that will be delivered on Saturday.** If the CLASS contractor cannot notify the laboratory of a Saturday delivery, there may not be anyone present at the CLP laboratory to receive samples until Monday.

## 6.5 Sample Cooler Returns

### Regional and Regional Support Contractor Responsibilities

The EPA Regions and their support contractors are responsible for providing a mechanism for shipping empty sample coolers from the CLP laboratories back to the originating sampling office. AOC provides the following suggestions to maintain consistency among cooler transportation programs:

- Sampling contractors should include a completed shipping label in the cooler, which can have any coded information for tracking purposes.
- The label should consist of multi-copies so the laboratory and the sampling contractors can each retain one for their records.
- The label should be designed so that the laboratory can simply place the already-completed label on the cooler for shipment purposes.
- The label should include third-party billing information so that the transportation carrier is able to invoice the correct sampling contractor. The laboratory should be informed of the identity of the carrier.
- To avoid confusion, each Region should attempt to use only a minimum number of different carriers.
- Sufficient information should be included on the label to enable the sampling contractor to track use of the billing number.
- The process should be as easy as possible for the laboratories.

### Laboratory Responsibilities

The laboratory is required to return sample coolers to the appropriate sampling office within 14 calendar days following shipment receipt. The laboratory should ensure that the account numbers provided by the Region are used only for the return of Government-owned shipping containers.

Laboratories are required to remove packing and other materials from the coolers before each pick-up and are required to ensure that the coolers are clean. Laboratories can determine from visual inspection if the coolers are clean. An authorized laboratory official is required to sign and telefax the pick-up records to the designated transportation contractor or sampler within two calendar days of cooler pick-up for return.

If laboratories do not follow the procedures, notify the TPO listed in Exhibit 7-1 for the Region where the laboratory is located.

## 7.0 COMMUNICATION NETWORK

This section provides Regional contacts for questions or concerns regarding CLP Analytical Services sampling and analysis. Exhibit 7-1 lists names and telephone numbers for Regional Technical Project Officers, who serve as the first line of contact for the laboratory for all technical problem resolution. Exhibit 7-2 gives names, addresses, and telephone numbers of Regional primary RSCCs. These contacts are available for CLP Analytical Services analytical requests and serve as the first contact for information regarding sampling. Exhibit 7-3 gives names, addresses, and telephone numbers of the CLASS Regional CLP Analytical Service contacts, who serve as a second contact for information regarding sampling. The RSCCs and CLASS coordinators can advise samplers regarding problems that occur in the field.

**Exhibit 7-1. Regional Technical Project Officers**

Region	Technical Project Officer	Telephone Number
Region I	Deb Szaro, Moira Lataille	(617) 860-4312
Region II	Pat Sheridan	(908) 906-6169
Region III	Stevie Wilding	(410) 573-6833
Region IV	Gary Bennett	(706) 546-3287
Region V	Brian Freeman	(312) 353-2720
Region VI	Ray Flores	(713) 983-2139
Region VII	Larry Marchun	(913) 551-5170
Region VIII	Steve Callio	(303) 312-7290
Region IX	Steve Remaley	(415) 744-1496
Region X	Bruce Woods	(206) 553-1193

**Exhibit 7-2. RSCC Addresses and Contacts**

<b>Regional Sample Control Centers</b>	<b>Primary RSCC</b>
USEPA Region I, WMD 60 Westvoew Street Lexington, MA 02173	Christine Clark (617) 860-4615
USEPA Region II, ESD 2890 Woodbridge Ave. Bldg. 209, MS220 Edison, NJ 08837	Phil Guarraia (908) 321-6697
USEPA Region III, CRL 201 Defense Highway, Suite 200 Annapolis, MD 21401	Carolyn Sierra (410) 573-2755
USEPA Region IV, ESD Env. Compliance Branch College Station Road Athens, GA 30613	Bill Bokey (706) 546-3299
USEPA Region V, WMD 77 W. Jackson Blvd. (HSMC-5J) Chicago, IL 60604	Cecilia Luckett (312) 886-1488
USEPA Region VI, Laboratory 10625 Fallstone Road Houston, TX 77099	Myra Perez (713) 983-2130
USEPA Region VII, ESD 25 Funston Rd. Kansas City, KS 66115	Nicole Roblez (913) 551-5130
USEPA Region VIII, SES-MEB 999 18th St. 5th Floor Denver, CO 80202	Carol Beard (303) 312-6047
USEPA Region IX, OPM, P-3-2 75 Hawthorne St. San Francisco, CA 94105	Gail Jones (415) 744-1498
USEPA Region X, ESD 1200 Sixth Ave. (M/S ES-095) Seattle, WA 98101	Laura Castrilli (206) 553-4323/1795

\* Primary RSCC assignments are subject to change.

**Exhibit 7-3. CLASS CLP Analytical Services Coordinators <sup>1</sup>**

Region	CLASS Regional Coordinator <sup>2</sup>	Telephone Number
Region I	Neil Rogers	(703) 519-1019
Region II	Neil Rogers	(703) 519-1019
Region III	Carol Shaeffer	(703) 519-1461
Region IV	Carol Shaeffer	(703) 519-1461
Region V	Mistie Llewellyn	(703) 519-1084
Region VI	Mistie Llewellyn	(703) 519-1084
Region VII	Mistie Llewellyn	(703) 519-1084
Region VIII	Carol Shaeffer	(703) 519-1461
Region IX	Neil Rogers	(703) 519-1019
Region X	Neil Rogers	(703) 519-1019

<sup>1</sup> The address for CLASS is Contract Laboratory Analytical Services Support, P.O. Box 818, Alexandria, VA, 22313. The phone number for CLASS is (703) 519-1200.

<sup>2</sup> The coordinator assignment is subject to change.

## 8.0 GLOSSARY

**AOC:** Analytical Operations Center. The U.S. EPA Center which directs the national Contract Laboratory Program.

**APO:** Administrative Project Officer. The APOs are part of AOC and monitor laboratory performance, initiate contract action and laboratory funding, help resolve problems, and develop and design analytical services and methods.

**Aliquot:** A measured portion of a sample taken for analysis. One or more aliquots make up a sample.

**Case:** A finite, usually predetermined number of samples collected over a given time period from a particular site. A Case consists of one or more sample delivery groups (SDGs). See sample delivery group.

**Case number:** Number assigned to a set of CLP Analytical Services samples by the CLASS contractor for tracking purposes.

**CLASS:** Contract Laboratory Analytical Services Support. The contractor-operated CLASS office provides management, operations, and administrative support to the CLP. The CLASS contractor schedules sample shipment for CLP Analytical Services requests.

**CLP:** Contract Laboratory Program. The CLP provides analytical services to the 10 EPA Regions through contracted commercial laboratories.

**CLPAS:** Routine CLP Analytical Services performed by laboratories that have been awarded CLP government contracts.

**Concentration:** Defined as high, medium, or low and used to determine how much volume is collected or the analytical protocol to be followed.

**Data turnaround time:** The maximum length of time allowed for laboratories to submit analytical data to EPA in order to avoid liquidated damages. Data turnaround time begins at the validated time of sample receipt (VTSR) at the laboratory.

**DOT:** Department of Transportation.

**Fraction:** A specific subunit of an analytical protocol. For example, for low/medium organics, the fractions are volatiles, semivolatiles, and pesticides/Aroclors.

**FORMS II:** FORMS II is software that facilitates the capture of field information during sampling events, and automates the production of bottle labels, sample tags, bottle-specific custody seals, chain-of-custody records, cooler seals, PRP sample receipt records, and field reports.

**Headspace:** Air pocket in a VOA vial.

**Holding time:** The maximum amount of time a sample may be stored before analysis.

**IATA:** International Air Transportation Association.

**Matrix:** The principal material of which the sample is composed of, usually water or soil/sediment for CLP Analytical Services samples.

**NEIC:** National Enforcement Investigations Center, a part of EPA, which is supporting the Agency's enforcement program, located in Denver, Colorado.

**Preservative:** A chemical added to inorganic and volatile water samples to maintain the integrity of the sample. Some common preservatives include nitric acid, hydrochloric acid, and sodium hydroxide.

**QC Samples:** Samples used to estimate the precision and accuracy of analytical results in the field and in the laboratory.

**RSCC:** Regional Sample Control Center. The RSCC coordinates Regional sampling efforts.

**Sample:** A single, discrete portion of the environment collected from a specified physical location at a specific time. The single sample may be placed in multiple vessels. The aliquots are identified by the same sample number.

**Sample container:** The individual bottle that contains the sample or an aliquot of the sample. The type of sample container varies for different sample fractions and concentrations.

**Sample custody:** Legal possession of and responsibility for an EPA sample. Documentation of sample custody is maintained on the chain-of-custody part of the traffic report or packing list. The sample is in your custody if any of the following criteria are met: 1) the sample is in your possession or is in your view after being in your possession, 2) the sample was in your possession and then locked up or sealed to prevent tampering, or 3) you have placed the sample in a secured area.

**Sample label:** Adhesive labels distributed by the RSCC that provide the sample numbers to be assigned to the samples.

**Sample number:** The sample number from the sample label that identifies the sample or an aliquot of the sample.

**SDG:** The sample delivery group (SDG) is a unit within a Case that is used to identify a group of samples for delivery. An SDG is defined as one of the following, whichever comes first:

- all samples within a Case, or
- every set of 20 field samples within a Case, or
- all field samples in a Case which are received at a laboratory during a specified period of time, beginning with receipt of the first sample in the Case or SDG.

**SOW:** Statement of work. This document specifies how laboratories analyze samples under a particular CLP analytical program.

**Station location:** The specific location where samples are collected on a site.

**TAL:** Target Analyte List. TALs list the target analytes to test for in inorganic analyses.

**TCL:** Target Compound List. TCLs list the target compounds to test for in organic analyses.

**TPO:** Regional Technical Project Officer. The TPO monitors the activities of the contract laboratories located in his or her Region.

**TR/COC:** CLP Analytical Services Traffic Report/Chain of Custody form. This form is used to track CLP Analytical Services samples from sample collection to sample receipt by the laboratory.

**Volume:** The amount of sample collected. Volume requirements differ between CLP Analytical Services programs, matrices, fractions, and concentrations.



**VOA:** Volatile Organic compound Analysis. Used synonymously with VOC.

**VOC:** Volatile Organic Compound.

**VTSR:** Verified Time of Sample Receipt.

## 9.0 EPA REFERENCE DOCUMENTS

Copies of the EPA Reference documents may be obtained from:

National Technical Information Service  
U.S. Department of Commerce  
5285 Port Royal Road  
Springfield, VA 22161  
(703) 487-4650

U.S. EPA, "The Data Quality Objectives process for Environmental Decisions," QAMS EPA QA/G4.

U.S. EPA, "The Data Quality Objectives process for Superfund," EPA/540-R-93-071.

U.S. EPA, "EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations," EPA QA/R5.  
Draft Interim Final, August 1994.

U.S. EPA, "EPA Requirements for Quality Management Plans," QAMS Interim Final, 8/94.

U.S. EPA, "User's Guide to the Contract Laboratory Program," EPA/540/P-91/002, 1991.

U.S. EPA, Compendium of ERT Surface Water and Sediment Sampling Procedures, EPA/540/P-91/005.

U.S. EPA, Compendium of ERT Soil Sampling and Surface Geophysics Procedures, EPA/540/P-91/006.

U.S. EPA, Compendium of ERT Groundwater Sampling Procedures, EPA/540/P-91/007.

U.S. EPA, Soil Sampling and Analysis for Volatile Organic Compounds, EPA/540/4-91/001.

U.S. EPA, Technical Notes on Drinking Water Methods, EPA/600/R-94/173.

*Specifications and Guidance for Contaminant-Free Sample Containers*, December 1992, OSWER Directive 92.0-05A.


Current CLP Statements of Work are available through NTIS and the CLU-IN Bulletin Board [System Operator at (301) 589-8368] on the Internet (via telnet) at CLU-IN.EPA.GOV.

US Army Corps of Engineers, Requirements for the Preparation of Sampling and Analysis Plans, Draft, June 30, 1994.  
EM 200-1-3.

**APPENDIX G**

**CLP PAPERWORK**  
**REQUIREMENTS**

Example

 United States Environmental Protection Agency Contract Laboratory Program										<b>Organic Traffic Report &amp; Chain of Custody Record</b> (For Organic CLP Analysis)										Case No. <b>12345</b>	
1. Project Code —				2. Region No. <b>5</b>		3. Sampling Co. <b>IEPA</b>		4. Date Shipped <b>10/10/01</b>		Carrier <b>Fed Ex</b>		6. Matrix (Enter in Column A) 1. Surface Water 2. Ground Water 3. Leachate 4. Field QC 5. Soil/Sediment 6. PE-water 7. PE-soil 8. Other (specify in Column A)		7. Preservative (Enter in Column D) 1. HCl 2. HNO3 3. NaHSO4 4. H2SO4 5. Ice only 6. CH3OH 7. Other (specify in Column D) N. Not Preserved							
Account Code —				Sampler (Name) <b>Name</b>				Airbill Number <b>12345679</b>				5. Ship To: <b>Lab Name</b> <b>Lab Address</b> <b>City, State Zip</b>  ATTN: <b>Lab Contact</b>									
Site Name <b>Site Name</b>				Sampler Signature <b>Signature</b>																	
City, State <b>City, IL</b>		Site Spill ID <b>N/A</b>		Op Unit <b>—</b>		3. Purpose** <input type="checkbox"/> SF <input type="checkbox"/> PRP <input type="checkbox"/> ST <input type="checkbox"/> FED <input type="checkbox"/> BZ		Early Action <input type="checkbox"/> IA <input type="checkbox"/> PA <input type="checkbox"/> REM <input type="checkbox"/> RI <input checked="" type="checkbox"/> SI <input type="checkbox"/> ESI		Long-Term Action <input type="checkbox"/> RIFS <input type="checkbox"/> RD <input type="checkbox"/> RA <input type="checkbox"/> O&M											
CLP Sample Numbers (from labels)	A Matrix (from Box 6) Other	B Conc.: Low Med	C Sample Type: Comp./Grab	D Preservative (from Box 7) Other	E RAS Analysis			F Regional Specific Tracking Number or Tag Numbers	G Station Location Identifier	H Mo/Day/ Year/Time Sample Collection	I Corresponding CLP Inorganic Sample No.	J Sampler Initials	K Field QC Qualifier  B = Blank S = Field Spike D = Field Duplicate R = Rinsate PE = Perform Eval								
					TA (circle one) PR 7 14 (21)	TA (circle one) PR 7 14 (21)	TA (circle one) PR 7 14 (21)														
EA101	2	L	G	1,5	X	X	X	5-12354-712363	MW01	10/10/01 8:30	MEA101										
EA102	2	L	G	1,5	X	X	X	5-12364-712369	MW02	10/10/01 8:50	MEA102										
EA103	2	L	G	1,5	X	X	X	5-12370-712375	MW02	10/10/01 8:50	MEA103		D--EA102								
EA104	2	L	G	1,5	X	X	X	5-12376-712381	MW03	10/10/01 9:15	MEA104										
EA105	4	L	G	1,5	X	X	X	5-12382-712387	FB01	10/10/01 10:00	MEA105		B								
EA106	4	L	G	1	X			5-12388-712389	TB01	10/10/01 10:15	—		B								
Shipment for Case Complete (Y/N) <b>Y</b> Page <b>1</b> of <b>1</b>																					
VOA MS/MSD Required? <b>Y/N</b> Sample #: <b>EA101</b> BNA MS/MSD Required? <b>Y/N</b> Sample #: <b>EA101</b> Pest/PCB MS/MSD Required? <b>Y/N</b> Sample #: <b>EA101</b>																					
Additional Sampler Signatures Chain of Custody Seal Number(s) <b>1234 + 1235</b>																					

\*PR provides 7-day data turnaround in addition to preliminary results. Requests for preliminary results will increase analytical costs.

### Chain of Custody Record

Relinquished by: (Signature) <b>Signature</b>	Date / Time <b>10/10/01 12:00</b>	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks: Is custody seal intact? Y/N/none	

OCT 16 2001

Distribution: Blue - Region Copy  
White - Lab Copy for Return to SMO  
Pink - SMO Copy  
Yellow - Lab Copy for Return to Region

See Reverse for Additional Standard Instructions

\*\*See Reverse for Purpose Code Definitions

CLASS 99-001

Form 9110-2 (2/99)

201105



## Inorganic Traffic Report & Chain of Custody Record (For Inorganic CLP Analysis)

Case No.

12345

1. Project Code —		Account Code —		2. Region No. 5		Sampling Co. IEPA		4. Date Shipped 10/10/01		Carrier Fed Ex		6. Matrix (Enter in Column A) 1. Surface Water 2. Ground Water 3. Leachate 4. Field QC 5. Soil/Sediment 6. Oil (High only) 7. Waste (High only) 8. Other (specify in Column A)		7. Preservative (Enter in Column D) 1. HCl 2. HNO3 3. NaOH 4. H2SO4 5. K2Cr2O7 6. Ice only 7. Other (specify in Column D) N. Not preserved			
Regional Information —				Sampler (Name) Name				Airbill Number 12345678									
Non-Superfund Program —				Sampler Signature Signature				5. Ship To Lab Name Lab Address City, State Zip									
Site Name Site Name				3. Purpose				Early Action CLEM PA REM RI SI ESI				Long-Term Action FS RD RA O&M NPLD					
City, State City, IL		Site Spill ID N/A		Lead SF PRP ST FED								ATTN: Lab Contact					
CLP Sample Numbers (from labels)		A Matrix (from Box 6) Other:	B Conc.: Low Med High	C Sample Type: Comp./ Grab	D Preservative (from Box 7) Other:	E - RAS Analysis Diss. Metals Total Metals Cyanide NO2/NO3 Fluoride pH Conduct.					F Regional Specific Tracking Number or Tag Numbers		G Station Location Identifier	H Mo/Day/ Year/Time Sample Collection	I Corresponding CLP Organic Sample No.	J Sampler Initials	K Field QC Qualifier B = Blank S = Spike D = Duplicate R = Rinse PE = Perform Eval — = Not a QC Sample
MEA101		2	L	G	2,3	X	X				512345-712346	MW01	10/10/01 8:30	EA101			
MEA102		2	L	G	2,3	X	X				512347-712348	MW02	10/10/01 8:50	EA10.2			
MEA103		2	L	G	2,3	X	X				512349-712350	MW02	10/10/01 8:50	EA103		D-ME103	
MEA104		2	L	G	2,3	X	X				512351-712352	MW03	10/10/01 9:15	EA104			
MEA105		4	L	G	2,3	X	X				5-12353-712354	FBOL	10/10/01 10:00	EA107 105	10/10/01	B	
Shipment for Case Complete? (Y/N)		Page 1 of 1		Sample(s) to be Used for Laboratory QC ME101						Additional Sampler Signatures				Chain of Custody Seal Number(s) 1245 + 1246			

## CHAIN OF CUSTODY RECORD

Relinquished by: (Signature) <i>Signature</i>	Date / Time <i>10/10/01 12:00</i>	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	Is custody seal intact? Y/N/none

[illegible]

MEBWD3 - TOTAL METALS

MEBWD4 - TOTAL METALS

MEBWD5 - TOTAL METALS

MEBWD3 - TOTAL METALS

MEBWD4 - TOTAL METALS

MEBWD5 - TOTAL METALS

MEBWD3 - CYANIDE

MEBWD4 - CYANIDE

MEBWD5 - CYANIDE

MEBWD3 - CYANIDE

MEBWD4 - CYANIDE

MEBWD5 - CYANIDE

MEBWD3

MEBWD4

MEBWD5

MEBWD3

MEBWD4

MEBWD5

MEBWD3

MEBWD4

MEBWD5

Example - Inorganic CLP labels

# Example - Organic CLT labels

ECRD6 - EXTRACTABLE

ECRD7 - EXTRACTABLE

ECRD8 - EXTRACTABLE

ECRD6 - EXTRACTABLE

ECRD7 - EXTRACTABLE

ECRD8 - EXTRACTABLE

ECRD6 - EXTRACTABLE

ECRD7 - EXTRACTABLE

ECRD8 - EXTRACTABLE

ECRD6 - EXTRACTABLE

ECRD7 - EXTRACTABLE

ECRD8 - EXTRACTABLE

ECRD6 - VOA

ECRD7 - VOA

ECRD8 - VOA

ECRD6 - VOA

ECRD7 - VOA

ECRD8 - VOA

ECRD6

ECRD7

ECRD8

ECRD6

ECRD7

ECRD8

ECRD6

ECRD7

ECRD8

CRD6

ECRD7

ECRD8



U.S. ENVIRONMENTAL PROTECTION AGENCY  
REGION V  
OFFICIAL SEAL  
№ 185904

U.S. ENVIRONMENTAL PROTECTION AGENCY  
REGION V  
OFFICIAL SEAL  
№ 185903

Example of Chain of Custody Seals

Case # or Project Code <b>2002IE01</b>	Sample Number <b>501</b>	Month/Day/Year <b>10/10/01</b>	Time <b>11:00</b>	DESIGNATE		PRESERVATIVE: H <sub>2</sub> SO <sub>4</sub> <input type="checkbox"/> ICE <input checked="" type="checkbox"/> HCL <input type="checkbox"/> HNO <sub>3</sub> <input type="checkbox"/> NaOH <input type="checkbox"/> Other <input checked="" type="checkbox"/>	
				Comp.	Grab <input checked="" type="checkbox"/>		
Station Number and Location <b>SBO1</b>				Samplers (signatures) <i>Signature</i>		<b>ANALYSES</b>	
						VOA	<input checked="" type="checkbox"/> METALS
						ABN	CYANIDE
						PEST/PCB	
							Mercury
						Pesticides	Fluoride
						Herbicides	Nitrate/Nitrite
						PCB	TOC
						PCDD/PCDF	BOD
						2,3,7,8-TCDD	COD
						Ames Mutagen	TDS
						Asbestos	TSS
						Phosphorus	O&G
						Phenols	Sulfate
						PAH	Chloride
						TCLP	Sulfide
						TCX	Ammonia
						CBOD	Alkalinity
						Bio-Acute	Acidity
						Bio-Chronic	TKN
						Matrix:	
						Remarks:	
						USE FOR MS/MSD <input type="checkbox"/>	
Tag Number <b>5-100694</b>				Lab Sample Number			

Example Tag for CRL

Case # or Project Code <b>12345</b>	Sample Number <b>EA101</b>	Month/Day/Year <b>10/10/01</b>	Time <b>8:30</b>	DESIGNATE	
				Comp. <input checked="" type="checkbox"/>	Grab <input checked="" type="checkbox"/>
Station Number and Location <b>MW01</b>		Samplers (signatures) <i>Signature</i>		PRESERVATIVE: H <sub>2</sub> SO <sub>4</sub> <input type="checkbox"/> ICE <input checked="" type="checkbox"/> HCL <input checked="" type="checkbox"/> HNO <sub>3</sub> <input type="checkbox"/> NaOH <input type="checkbox"/> Other <input type="checkbox"/>	
				<b>ANALYSES</b>	
		VOA		<input checked="" type="checkbox"/> METALS	
		ABN		CYANIDE	
		PEST/PCB			
				Mercury	
		Pesticides		Fluoride	
		Herbicides		Nitrate/Nitrite	
		PCB		TOC	
		PCDD/PCDF		BOD	
		2,3,7,8-TCDD		COD	
		Ames Mutagen		TDS	
		Asbestos		TSS	
		Phosphorus		O&G	
		Phenols		Sulfate	
		PAH		Chloride	
		TCLP		Sulfide	
		TOX		Ammonia	
CBOD		Alkalinity			
Bio-Acute		Acidity			
Bio-Chronic		TKN			
Matrix:					
Remarks:					
USE FOR MS/MSD <input type="checkbox"/>					
Tag Number <b>5-100695</b>		Lab Sample Number			

Example Tag for CLP

## **Sample Labeling and shipment:**

### **U.S. EPA's Central Regional Laboratory (CRL):**

Sample labels will be attached to each individual sample bottle. Sample tags are not required for Brownfield projects, but are required for all Site Assessment activities. The label will include the field sample number, date/time of collection, type of analysis, sampler initials, and project name. Labels will be annotated with waterproof, permanent ink. CRL sample numbers will be written or pre-printed on the sample labels. CRL sample numbers will be assigned as needed for this project, and will be obtained from the U.S. EPA (Howard Pham, at this time). Generally, the CRL sample numbers are in the form of a 11 digit number, such as 2002BF04S01. The '2002' indicates the U.S. EPA fiscal year in which the samples are collected (U.S. EPA fiscal years begin October 1 and end the following September 31). The code 'BF' has been assigned to the Brownfield program pilots. Each State, however, has a code assigned to them and should use their code. The remainder of the number is a sequential number assigned by U.S. EPA such that each sample number is unique. Field blanks and trip blanks will be identified by coding the samples with an 'R' in place of the 'S', e.g., the first field blank or trip blank will be 2002BF04R01; the second will be 2002BF04R02. Water field duplicate samples will be identified by the CRL sample number by substituting a 'D' in the same sample number, e.g., 2002BF04S01 and 2002BF04D01 would be field duplicates. If the CRL is to scheduled to analyzes samples, a block of CRL sample numbers will be assigned (i.e., 2002BF04S01-S99). The first sample would be 2002BF04S01, the next would be 2002BF04S02, etc. The project consultant will keep track of which CRL log numbers assigned are used and will request more sample numbers if needed. Sample numbers not used will be returned to U.S. EPA for use with another project. Beginning on Oct. 1, 2001, the U.S. EPA **fiscal year** 2002 begins, and sampling numbers will be assigned with the following format: 2002BF01S01.

Samples shipped to the CRL will be documented on a Chain of Custody (COC) form (see example). **Samples generally cannot be shipped to the CRL for Saturday delivery.** The COC form will be filled out as in the example, including the site name, sampler names/signatures, time/date of sampling (in military time), type of sample, CRL sample number, the field station location, analyses requested will be listed in the right hand columns, the numbers of the COC seal numbers on the cooler, airbill number. The **top copy** of the completed COC form should be enclosed in a ziplock baggie taped to the inside lid of the cooler that contains the samples listed on the form. The CRL shipping Address is:

Bill Sargent,  
U.S. EPA, Region 5  
Central Regional Laboratory  
536 S. Clark St.  
10th Floor  
Chicago, IL 60605  
(312) 353-9083

Call Bill Sargent at the number above daily after shipment to the CRL, with airbill number, number of samples shipped, matrix, analyses requested, etc. Bill Sargent can be contacted concerning return shipment of empty coolers.

### **National Contract Laboratory Program (CLP):**

Sample labels will be prepared in a similar manner for samples shipped to the (CLP), except the site name will NOT be written on the sample label. Sample tags are not required for Brownfield projects, but are required for all Site Assessment activities. In place of the site name, the U.S. EPA assigned Case number will be written on the label. In addition, U.S. EPA will supply sample number labels for the CLP samples. These sample number labels will be used for this project only for samples scheduled through the CLP, and will be specific numbers for Region 5 U.S. EPA. These are the sample numbers that the lab results will be reported with. Region 5 labels begin with the letter 'E' for the organics and with 'ME' for inorganics. The 'E' represents Region 5 (E is the 5th letter in the alphabet; Region 1 labels begin with the letter 'A', Region 2 labels begin with the letter 'B', etc.). Typically, the organic and inorganic samples will be shipped to different laboratories. Samples shipped to the CLP will be documented on the CLP COC/Traffic Report form. This form is a standardized form used by all who send samples to the National CLP. The reverse side of the form contains instructions on completing the form. This form should be filled out and the **bottom two copies** shipped in a ziplock baggie taped to the inside lid of the cooler that contains the samples listed on the form. In addition, a third party air bill should be in the ziplock baggie, to be used by the CLP lab to return the coolers. A return address should be clearly identified on the airbill and on the cooler.

Call Heather Bauer, Dyncorp, at (703) 264-9348 daily with the airbill number, lab name(s), number and matrix of samples shipped, analyses requested, etc. **Samples can be shipped for Saturday delivery to CLP labs as long as this is prearranged with Dyncorp by Friday, 2:00 CST. Note also that the Fed Ex shipping form must also be clearly labeled for Saturday delivery!!!** Keep Howard Pham, Region 5 RSCC, (U.S. EPA (312) 353-2310) updated as the sampling event progresses, and let him know if the sampling is on schedule or if it'll run into the next week.

### **Sample Scheduling:**

Once the sampling and analysis plan is approved for specific site work, a sampling projection form will be filled out by the State project manager. This form will reflect the work approved in the sampling plan by the U.S. EPA Early Action Project Manager (EAPM), and will be submitted to the Regional Sample Control Coordinator (RSCC), Howard Pham, by the 15th of the month prior to the month of sampling or as soon as the sampling plan is approved. The week before sampling, the State must FAX the sampling confirmation form to the RSCC,. (Note that the RSCC checks with the EAPMs to confirm that the sampling plan is approved; sampling plans are due to the EAPM 10 days prior to sampling and must be approved before confirming CLP lab space. If the sampling plan is not approved, the RSCC will not schedule samples for the project.)

The RSCC will forward the weekly projections to the U.S. EPA contractor, Dyncorp, to get a case number assigned for that week, and to get the organic and inorganic laboratory assignments.

The case number and laboratory addressess will be FAXed to the project consultant by the Friday before the week of sampling. The samplers must call Dyncorp daily once sampling has begun, to report sample shipments to the CLP labs. Bill Sargent, U.S. EPA must be contacted daily if samples are being shipped to the CRL.

10/2001

**U.S. EPA REGION 5  
Monthly Projection Form- States**

**FAX THIS COMPLETED FORM TO HOWARD PHAM AT US EPA  
by the 15th of the month prior to sampling @ (312)-886-0186 or E-MAIL at: pham.howard@epa.gov**

Site Name/City, State \_\_\_\_\_

Date of Sampling Plan Approval/submittal: \_\_\_\_\_

Sampling Dates: \_\_\_\_\_ U.S. EPA EAPM \_\_\_\_\_

Activity Type: \_\_\_\_\_

(PA/SI, SI, ESI, Reassessment, BF TBA,

Potential scheduling/sampling complications \_\_\_\_\_

Sampler Name/Organization \_\_\_\_\_

Sampler Email address for CLP electronic data receipt: \_\_\_\_\_

Sampler Office Phone# \_\_\_\_\_ Field Phone # \_\_\_\_\_ Sampler Fax # \_\_\_\_\_

Please check all applicable requests: 7- day CLP\_\_\_\_ 14- day CLP\_\_\_\_ 21- day CLP\_\_\_\_

CRL (21 days, 30 days; circle one) CLP-CADRE Data Review Level \_\_\_\_\_ (see definitions below)

Level 1- CADRE Direct from HQ; Level 2- CADRE Review in Region; Level 3- Manual Review (See QAPP for  
rqmts. Site Assessment will use Level 2 or Level 3 (ESIs); Level 1 is the quickest but comes without the case  
narrative.)

Analysis Required(e.g., CLP VOA-EnCore, CLP VOA-MeOH, CLP SVOC-OLM, CLP Pest/PCB-OLM, CLP VOA-OLM,CLP VOA-OLC,CLP SVOC-OLC,CLP Pest/PCB-OLC, CLP Metals &CN, CRL Metals/CN(res.wells), etc.)	Matrix (soil, groundwater, surface water, sediment, drinking water, etc.)	Number of Samples (per matrix)

*SAS WORK Scheduled through the Region REQUIRES 3-4 weeks lead time, and an approved SAS client request form. All work to be scheduled  
must be included in an approved OAPP and sampling plan.*

**NOTIFY THE FOLLOWING PERSONS PRIOR to SHIPMENT, FOR CONFIRMATION**

CLP- RAS -Heather Bauer , Dyncorp, (703) 264-9348

SAS - (If Scheduled through Region) - Howard Pham (312) 353-2310

CRL- Bill Sargent- U.S. EPA - (312) 353-9083

Sampling Coordinator(signature/date)\_\_\_\_\_

10/2001

**U.S. EPA REGION 5  
Weekly Confirmation Form- States**

**FAX THIS COMPLETED FORM TO HOWARD PHAM AT US EPA  
by the Tuesday Noon the week prior to sampling @ (312)-886-0186 or E-MAIL at: pham.howard@epa.gov**

Name/City, State \_\_\_\_\_

Date of Sampling Plan Approval/submittal: \_\_\_\_\_

Sampling Dates: \_\_\_\_\_ U.S. EPA EAPM \_\_\_\_\_

Activity Type: \_\_\_\_\_

(PA/SI, SI, ESI, Reassessment, BF TBA,

Potential scheduling/sampling complications \_\_\_\_\_

Sampler Name/Organization \_\_\_\_\_

Sampler Email address for CLP electronic data receipt: \_\_\_\_\_

Sampler Office Phone# \_\_\_\_\_ Field Phone # \_\_\_\_\_ Sampler Fax # \_\_\_\_\_

Please check all applicable requests: 7- day CLP\_\_\_ 14- day CLP\_\_\_ 21- day CLP\_\_\_

CRL (21 days, 30 days; circle one) CLP-CADRE Data Review Level\_\_\_\_\_ (see definitions below)

Level 1- CADRE Direct from HQ; Level 2- CADRE Review in Region; Level 3- Manual Review (See QAPP for  
rqmts. Site Assessment will use Level 2 or Level 3 (ESIs); Level 1 is the quickest but comes without the case  
narrative.)

Analysis Required(e.g., CLP VOA-EnCore, CLP VOA-MeOH, CLP SVOC-OLM, CLP Pest/PCB-OLM, CLP VOA-OLM,CLP VOA-OLC,CLP SVOC-OLC,CLP Pest/PCB-OLC, CLP Metals &CN, CRL Metals/CN(res.wells), etc.)	Matrix (soil, groundwater, surface water, sediment, drinking water, etc.)	Number of Samples (per matrix)

*\* SAS WORK Scheduled through the Region REQUIRES 3-4 weeks lead time, and an approved SAS client request form. All work to be scheduled  
to be included in an approved QAPP and sampling plan.*

**NOTIFY THE FOLLOWING PERSONS PRIOR to SHIPMENT, FOR CONFIRMATION**

CLP- RAS -Heather Bauer , Dyncorp, (703) 264-9348

SAS - (If Scheduled through Region) - Howard Pham (312) 353-2310

CRL- Bill Sargent- U.S. EPA - (312) 353-9083



5. Planning Coordinator(signature/date)\_\_\_\_\_ 10/2001

**APPENDIX H**

**MONITORING**

**POINT/SAMPLING POINT**

**NUMBERING SYSTEM**

## Monitoring Point/Sampling Point Numbering System

*When I am  
going to  
take  
a sample  
I will  
follow*

The monitor/sample point number identifies a specific location where a sample is taken. The first character of the number must be an alpha identifier. The second, third and fourth characters are to be numeric identifiers. The following guidelines should assist in assigning monitor sample point numbers for the majority of the situations.

- A. The first and second characters identify the type of monitor/sample
- B. The third and four characters designate the sample number.
- C. In the case of monitoring well identification, use the well number for the ID. In most other sampling, the samples can be numbered sequentially.

The following key provides the appropriate first and second characters of the monitor/sample point number.

<u>G - Groundwater</u>	<u>S - Surface Water</u>	<u>X - Special</u>	<u>L - Leachate</u>
1. Monitoring well	1. Stream*	1. Soil	1. Flow or seep
2. Private well	2. Impoundment	2. Sediment **	2. Pond***
3. Piezometer	3. Run-off (Channeled or Sheet flow)	3. Waste (Container-any Unit of 120 gal. Or less)	3. Collection System (Riser, sump)
4. Interceptor Trench/ Collector System	4. Run-on (Channeled or Sheet flow)	4. Waste (Tank-any unit of >120 gal.)	
5. Public Water Supply Well		5. Other (waste disposed of On the ground, etc.)	
6. Spring			

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\*Example: S101 - Downstream sample taken FIRST  
S102 - Farther Upstream

Sample point numbers will progressively increase upstream. The last upstream sample will end sequence and likely to be the stream background.

\*\*Same procedures as example above but using "X" characters

\*\*\*Where a seep or flow ponds. No surface water associated with this